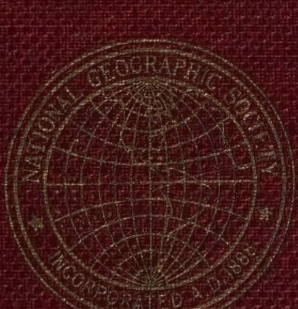
WILD ANIMALS OF NORTH AMERICA


NATIONAL GEOGRAPHIC SOCIETY
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Th. M. Schintz

Wild Animals of North America

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WILD ANIMALS
OF NORTH AMERICA

Intimate Studies of Big and Little Creatures
of the Mammal Kingdom

By E. W. Nelson, A. M., D. Sc.
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FORMERLY CHIEF U. S. BIOLOGICAL SURVEY

WITH ILLUSTRATIONS FROM PAINTINGS BY
LOUIS AGASSIZ FUERTES and
DRAWINGS OF TRACKS BY ERNEST THOMPSON SETON

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FOREWORD

IN OFFERING this revised volume of "Wild Animals of North America" to members of the National Geographic Society, the Editor combines the text and illustrations of two entire numbers of the NATIONAL GEOGRAPHIC MAGAZINE which were devoted to the Larger Mammals and the Smaller Mammals of North America, respectively.

Dr. Edward W. Nelson, the author of both articles, is one of the foremost naturalists of our time. For more than fifty years he has been the friend and student of North America's wild-folk. He has made his home in forest and desert, on mountain side and plain, amid the snows of Alaska and the tropical heat of Central American jungles—wherever Nature's creatures of infinite variety were to be observed, their habits noted, and their range defined.

In the whole realm of scientists, The Society could not have found a writer more admirably equipped for the authorship of a book such as "Wild Animals of North America" than Dr. Nelson; for, in addition to his exceptional scientific training and his standing as former Chief of the unique United States Biological Survey, he possesses the rare quality of the born narrator, able to visualize for the reader the things which he has seen and the experiences which he has undergone in seeing them. Each of his animal biographies, of which there are 120 in this volume, is a cameo brochure—concisely and entertainingly presented, yet never deviating from scientific accuracy.

In Mr. Louis Agassiz Fuertes, the National Geographic Society secured for Dr. Nelson the same gifted artist who illustrated "Common Birds of Town and

Country," "The Warblers," and "American Game Birds," all of which were assembled in The Society's "Book of Birds." For the Wild Animal book Mr. Fuertes produced a natural-history gallery of paintings of the Larger and Smaller Mammals of North America which is a notable contribution to wild-life portraiture, and the reproductions of these works of art are among the most effective examples of color printing ever produced in this country.

Supplementing the work of Dr. Nelson and Mr. Fuertes is a series of drawings by the noted naturalist and nature-lover, Mr. Ernest Thompson Seton, showing the tracks of many of the most widely known mammals.

"Wild Animals of North America" provides in compact and permanent form a natural history for which the National Geographic Society expended $100,000 in the two issues of The Magazine in which the articles and illustrations originally appeared. For this revised edition of 1930, the author has reassembled his biographies into groups, with an introduction for each, so that the text may be more readily adapted to the use of students of zoölogy, without sacrificing in any particular its popular appeal.

GILBERT GROSVENOR,
President and Editor.

WILD ANIMALS OF NORTH AMERICA

Chapter I

General Characteristics and Origin of the Mammal Fauna
The Larger Species and Some of Their Predecessors

THAT part of the North American Continent, the neighboring islands and adjacent seas lying north of the Mexican boundary, is the region specially considered in this work. Within these limits exist more than 1,500 species and geographic subspecies of mammals. The larger species, including the big-game animals, the larger fur bearers, the seals and other sea mammals, are best known, although they form only a small part of the total.

By far the greater number of our mammal fauna is made up of small species, the majority of which are so small and either nocturnal or so retiring in habits that few except a limited number of field naturalists ever come in contact with them in life, or are even aware of their existence. What has been discovered concerning the life histories of many of these little beasts is often strange and remarkably interesting.

CHANGING CLIMATE CHANGES LIFE

Although the southern limit of our territory is ostensibly the Mexican boundary, yet a considerable number of the species living north of it also exist south of it, in the case of the mountain lion even so far as Patagonia. To complete the sketch of the lives of such species it is necessary to follow where they go. In the same manner, some northern species lead us to the icy shores of Greenland and to the vast area of Siberia.

The groups into which the mammals of North America are classified, according to their structural relationships, often have representatives in other far parts of the world. In fact, our mammals form part of a great network of interrelated organized life covering the earth, but frayed and broken in many places by time. Some of the species are of native origin and more or less local distribution, but others, either existing to-day or preserved in fossil beds, prove that the ancestors of many of our species once roamed far-distant lands, some of them now separated by abysmal oceanic depths.

The differences in the geographic distribution of mammal life between North and South America and the relationships between our fauna and that of the Old World are parts of the latest chapter of a wonderful story running back through geologic ages. The former chapters are recorded in the fossil beds of all the continents. While only a good beginning has been made in deciphering these records, enough has been done by the fascinating researches of Marsh, Cope, Osborn, Scott, and others to prove that in all parts of the earth one fauna has succeeded another in marvelous procession.

It has been shown also that these changes in animal life, accompanied by equal changes in plant life, have been largely brought about by variations in climate and by the uplifting and depressing of continental land-masses above or below the sea. The potency of climatic influence on animal life is so great that even a fauna of large mammals will be practically destroyed over a great area by a long-continued change of comparatively few degrees (probably less than ten degrees Fahrenheit) in the mean daily temperatures.

VAST MUSEUMS OF EXTINCT ANIMAL LIFE

For ages middle and northern Asia appears to have served as a vast and fecund nursery for new mammals from which North Temperate and Arctic America have been supplied. The last and comparatively recent land bridge, across which came the ancestors of our moose, elk, caribou, pronghorn antelope, mountain goats, mountain sheep, musk oxen, bears, and many other mammals, was in the far Northwest, where Bering Strait now forms a channel only about 56 miles wide separating Siberia from Alaska.

Photograph by Capt. F. E. Kleinschmidt

A SWIMMING POLAR BEAR

He does not use his hind legs at sea, a fact brought out by the motion-picture camera. These animals are as thoroughly at home in the water as are the otters, but they are less agile, owing to their size.

Photograph by Capt. F. E. Kleinschmidt

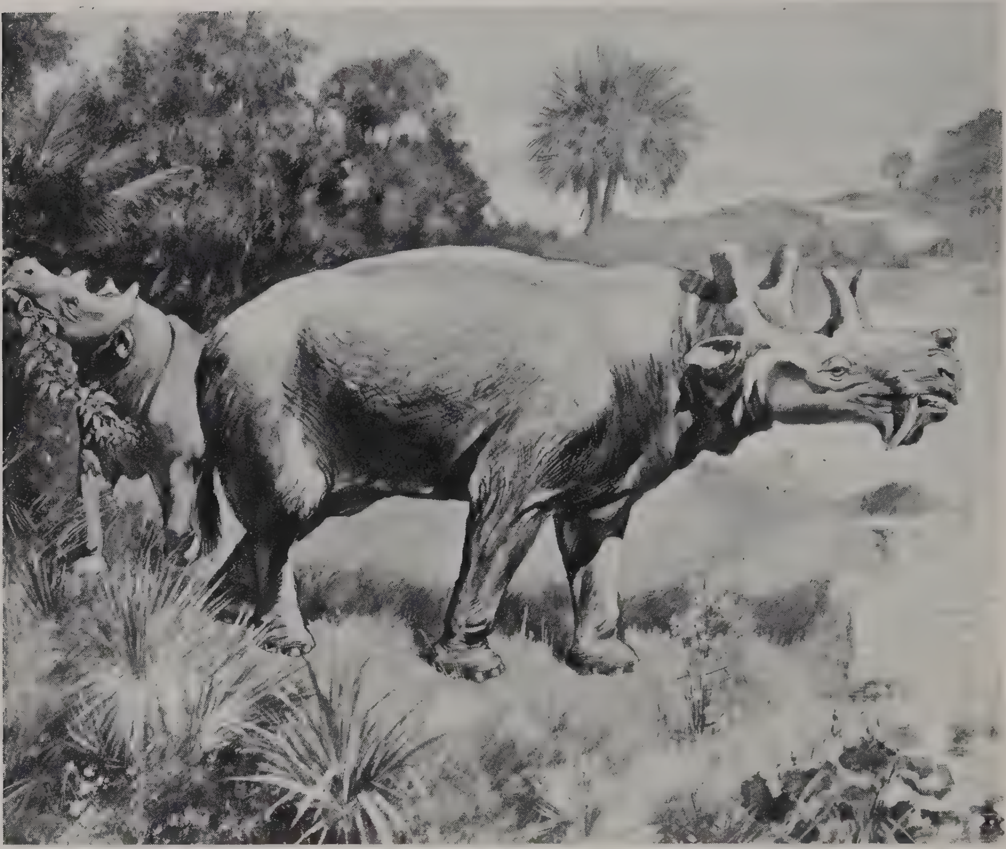
TOWING HER BABY TO SAFETY

When a mother polar bear scents danger she jumps into the water and her cub holds fast to her tail while she tows it to safety. But when no danger seems to threaten she wants it to "paddle its own canoe," and boxes its ears or ducks its head under water if it is too lazy to swim for itself.

The fossil beds of the Great Plains and other parts of the country contain eloquent proofs of the richness and variety of mammal life on this continent at different periods in the past. Perhaps the most wonderful of all these ancient faunas was that revealed by the bones of birds and mammals which had been trapped in the asphalt pits discovered some years ago in the outskirts of Los Angeles, California. These bones show that prior to the arrival of the present fauna the plains of southern California swarmed with an astonishing wealth of strange birds and beasts.

The most notable of these were saber-toothed tigers, lions much larger than those of Africa; giant wolves, several kinds of bears, including the huge cave bears, even larger than the gigantic brown bears of Alaska; large wild horses, camels, bison (different from our present animal); tiny antelope the size of a fox; mastodons, mammoths with tusks 15 feet long; and giant ground sloths, in addition to many other species, large and small.

With these amazing mammals were equally strange birds, including, among numerous birds of prey, a giant vulture-



From a drawing by Charles R. Knight

A GROTESQUE CREATURE THAT ONCE LIVED IN THE UNITED STATES

It had six horns on the head and, in some species, two long canine teeth projecting downward from the upper jaw. The feet were somewhat like those of an elephant, but the skull and teeth resemble nothing on earth to-day. This great beast, the Uintatherium, roamed the plains of Wyoming during the Eocene period.

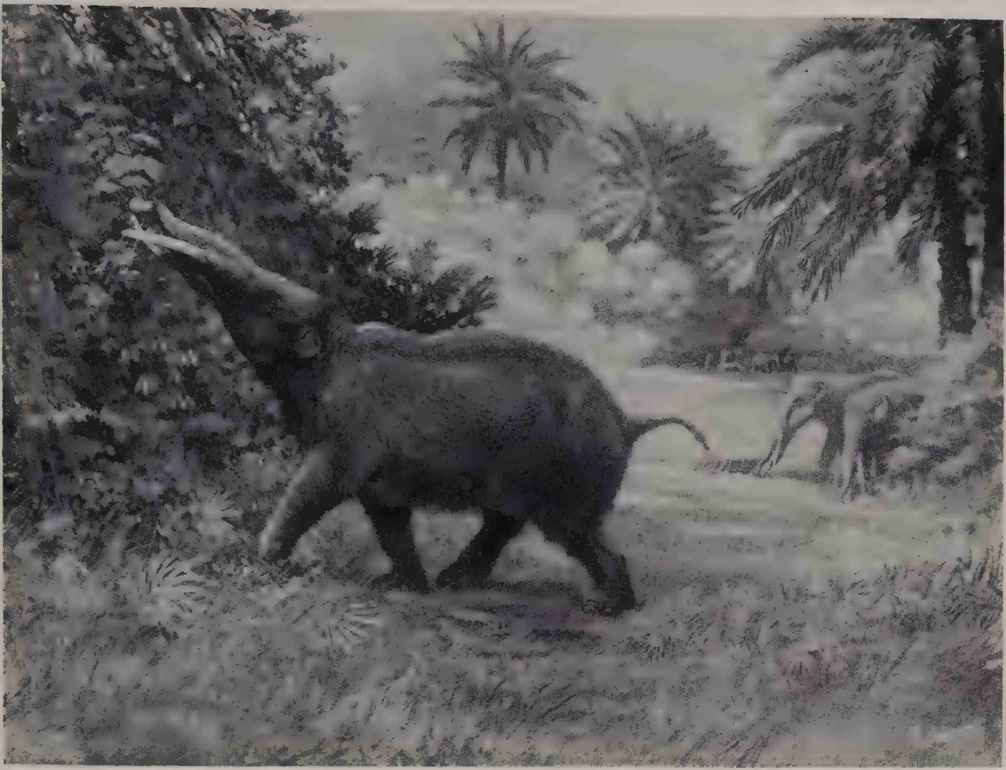
like species (far larger than any condor), peacocks, and many others.

DID MAN LIVE THEN?

The geologically recent existence of this now vanished fauna is evidenced by the presence in the same asphalt pits of bones of the gray fox, the mountain lion, and close relatives of the bobcat and coyote, as well as the condor, which still frequent that region, and thus link the past with the present. The only traces of the ancient vegetation discovered in these asphalt pits are a pine and two species of juniper, which are members of the existing flora.

There is reason for believing that primitive man occupied California and other parts of the West during at least the latter part of the period while some of the strange fauna of the asphalt pits still flourished. Dr. C. Hart Merriam informs me that the folklore of the locally restricted California Indians contains detailed descriptions of a beast which is unmistakably a bison, probably the bison of the asphalt pits.

The discovery in these pits of the bones of a gigantic vulturelike bird of prey of far greater size than the condor is even more startling, since the folklore of the Eskimos and Indians of most of the tribes from Bering Strait to California and of the Rocky Mountain region abounds in tales of the "thunderbird"—a gigantic bird of prey like a mighty eagle, capable of carrying away people in its talons. Two such coincidences suggest the possibility



From a drawing by Charles R. Knight

A PRIMITIVE FOUR-TUSKED ELEPHANT THAT LIVED AGES AGO IN THE UNITED STATES

This Trilophodon lived in the Miocene period. He stood about six feet high at the shoulders.

that the accounts of the bison and the thunderbird are really based on the originals of the asphalt beds and have been passed down in legendary history through many thousands of years.

CAMELS AND HORSES ORIGINATED IN NORTH AMERICA

Among other marvels, our fossil beds reveal the fact that both camels and horses originated in North America. The remains of many widely different species of both animals have been found in numerous localities extending from coast to coast in the United States. Camels and horses, with many species of antelope closely related to still existing forms in Africa, abounded over a large part of this country up to the end of the geological age immediately preceding the present era.

Then, through imperfectly understood changes of environment, a tremendous mortality among wild life took place and destroyed practically all of the splendid large mammals, which, however, have left their records in the asphalt pits of California and in other fossil beds throughout the country.

The wonderful fauna of the asphalt pits had vanished long before America was first colonized by white men, and had been replaced by another mainly from the Old World, less varied in character, but enormously abundant in individuals. Although so many North American mammals were derived from Asia, a few came from South America.

Some of the most characteristic types of our mammals, mainly small or medium-sized species, appear to have originated in North America. Among these are the mountain beavers, pocket gophers, kangaroo rats, pocket mice, wood rats, white-footed mice, muskrats, skunks, ring-tailed cats, and raccoons.

In Siberia and Europe live close counterparts of our northern weasels, mink, marten, field mice, lemmings, northern hares, conies, marmots, moles, and others; and on our southern border spotted cats, the hog-nosed skunk, and armadillo introduce a tinge of a strange fauna from South America.

AN INCREDIBLE PROFUSION OF MAMMALIAN LIFE WHEN COLONISTS ARRIVED

At the time of its discovery and occupation by Europeans, North America and the bordering seas teemed with an almost incredible profusion of large mammalian life. The hordes of game animals which roamed the primeval forests and plains of this continent were the marvel of early explorers and have been equaled in historic times only in Africa.

Even beyond the limit of trees, on the desolate Arctic Barrens, vast herds containing hundreds of thousands of caribou drifted from one feeding ground to another, sharing their range with numberless smaller companies of musk-oxen. Despite the dwarfed and scanty vegetation of this bleak region, the fierce winter storms and long arctic nights, and the harrying by packs of white wolves, these hardy animals continued to hold their own until the fatal influence of civilized man was thrown against them.

Southward from the Arctic Barrens, in the neighboring forests of spruce, tamarack, birches, and aspens, were multitudes of woodland caribou and moose. Still farther south, in the superb forests of eastern North America, and ranging thence over the limitless open Plains of the West, were untold millions of buffalo, elk, and white-tailed deer, with the pronghorn antelope replacing the white-tails on the Western Plains.

With this profusion of large game, which afforded a superabundance of food, there was a corresponding abundance of large carnivores, such as wolves, coyotes, black and grizzly bears, mountain lions, and lynxes. Black bears were everywhere except on the open plains, and numerous species of grizzlies occupied all the mountainous western part of the continent.

FUR TRADERS WERE FORERUNNERS FOR CIVILIZATION

Fur bearers, including beavers, muskrats, land otters, sea otters, fishers, martens, minks, foxes, and others, were so plentiful in the New World that immediately after the colonization of the United States and Canada a large part of the world's supply of furs was obtained here.

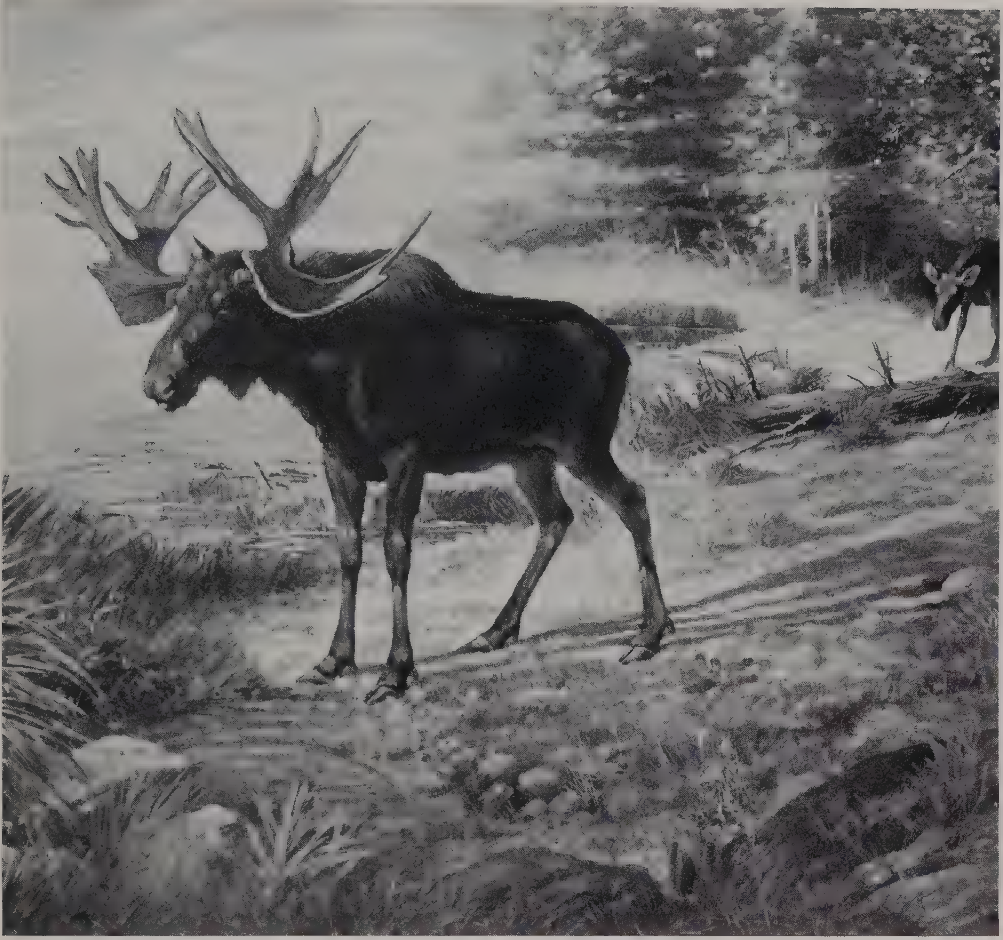
Trade with the Indians laid the foundations of many fortunes, and later developed almost imperial organizations, like the Hudson's Bay Company and its rivals. Many adventurous white men became trappers and traders, and through their energy, and the rivalry of the trading companies, we owe much of the first exploration of the northwestern and northern wilderness. The stockaded fur-trading stations were the outposts of civilization across the continent to the shores of Oregon and north to the Arctic coast. At the same time, the presence of the sea otter brought the Russians to occupy the Aleutian Islands, Sitka, and even northern California.

ADJOINING SEAS TEEMED WITH MAMMAL LIFE

The wealth of mammal life in the seas along the shores of North America almost equaled that on the land. On the east coast there were many millions of harp and hooded seals and walruses, while the Greenland right and other whales were extremely abundant. On the west coast were millions of fur seals, sea-lions, sea-elephants, and walruses, with an equal abundance of whales and hundreds of thousands of sea otters.

Many of the chroniclers dealing with explorations and life on the frontier during the early period of the occupation of America gave interesting details concerning the game animals. Allouez says that in 1680, between Lake Erie and Lake Michigan the prairies were filled with countless bears, wapiti, white-tailed deer, and turkeys, on which the wolves made fierce war. He adds that on a number of occasions this game was so little wild that it was necessary to fire shots to protect the party from it. Perrot states that during the winter of 1670-1671, 2,400 moose were snared on the Great Manitoulin Island, at the head of Lake Huron. Other travelers, even down to the nineteenth century, give similar accounts of the abundance of game.

The original buffalo herds are estimated to have contained from 30,000,000 to 60,000,000 animals, and in 1870 it was estimated that about 5,500,000 still survived.



From a drawing by Charles R. Knight

A MOOSE THAT LIVED IN NEW JERSEY IN PLEISTOCENE TIMES: CERVALCES

A nearly perfect skeleton of this primitive mooselike animal was found in southern New Jersey some years ago. In size and general proportions the animal resembled a modern moose, but the nose was less developed and the horns were decidedly different in character.

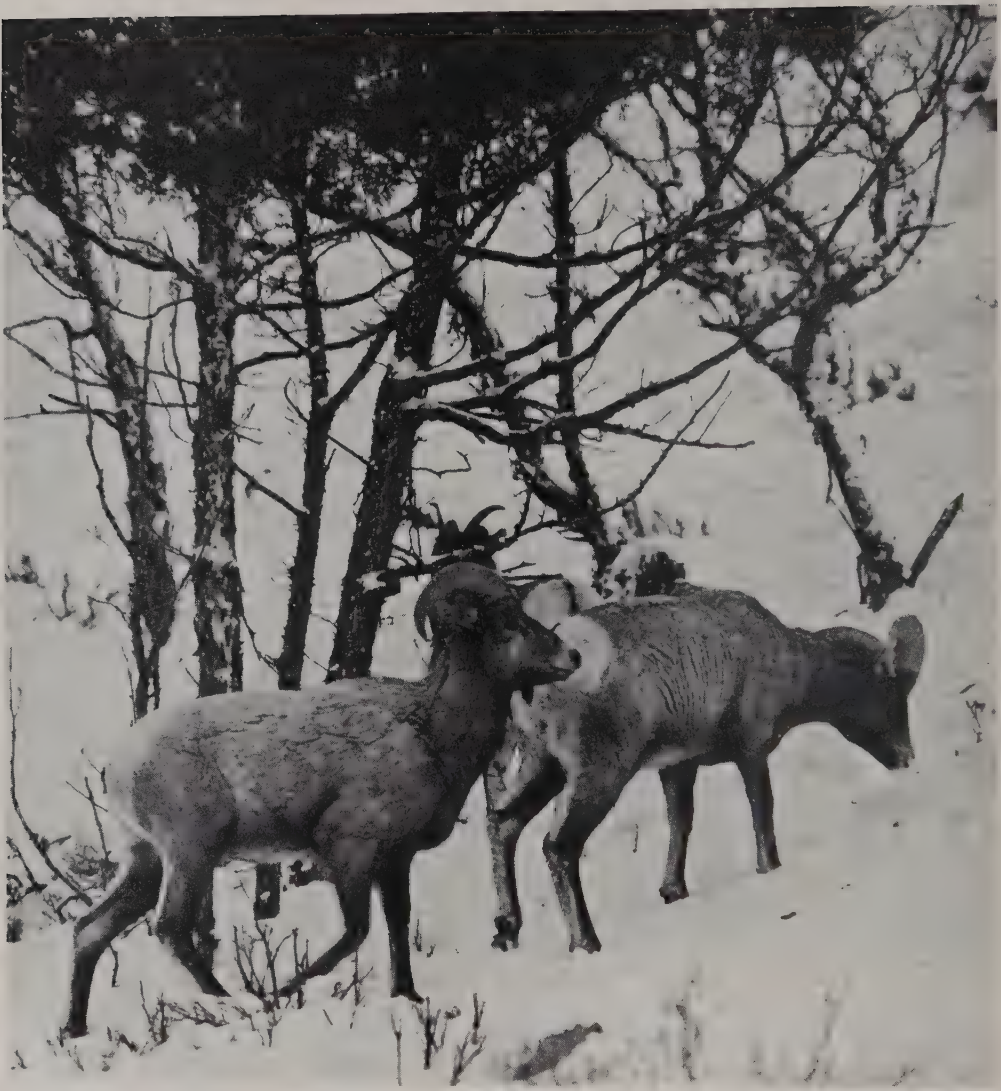
A number of men now living were privileged to see some of the great herds of the West before they were finally destroyed. Dr. George Bird Grinnell writes:

"In 1870, I happened to be on a train that was stopped for three hours to let a herd of buffalo pass. We supposed they would soon pass by, but they kept coming. On a number of occasions in earlier days the engineers thought that they could run through the herds, and that, seeing the locomotive, the buffalo would stop or turn aside; but after a few locomotives had been ditched by the animals the engineers got in the way of respecting the buffaloes' idiosyncrasies. . . .

"Up to within a few years, in northern Montana and southern Alberta, old buffalo trails have been very readily traceable by the eye, even as one passed on a railroad train. These trails, fertilized by the buffalo and deeply cut so as to long hold moisture, may still be seen in summer as green lines winding up and down the hills to and from the watercourses."

ANTELOPE EVERYWHERE

Concerning the former abundance of antelope, Dr. Grinnell says: "For many years I have held the opinion that in early days on the Plains, as I saw them, antelope were much more abundant than buf-



Photograph by Gus A. Swanson

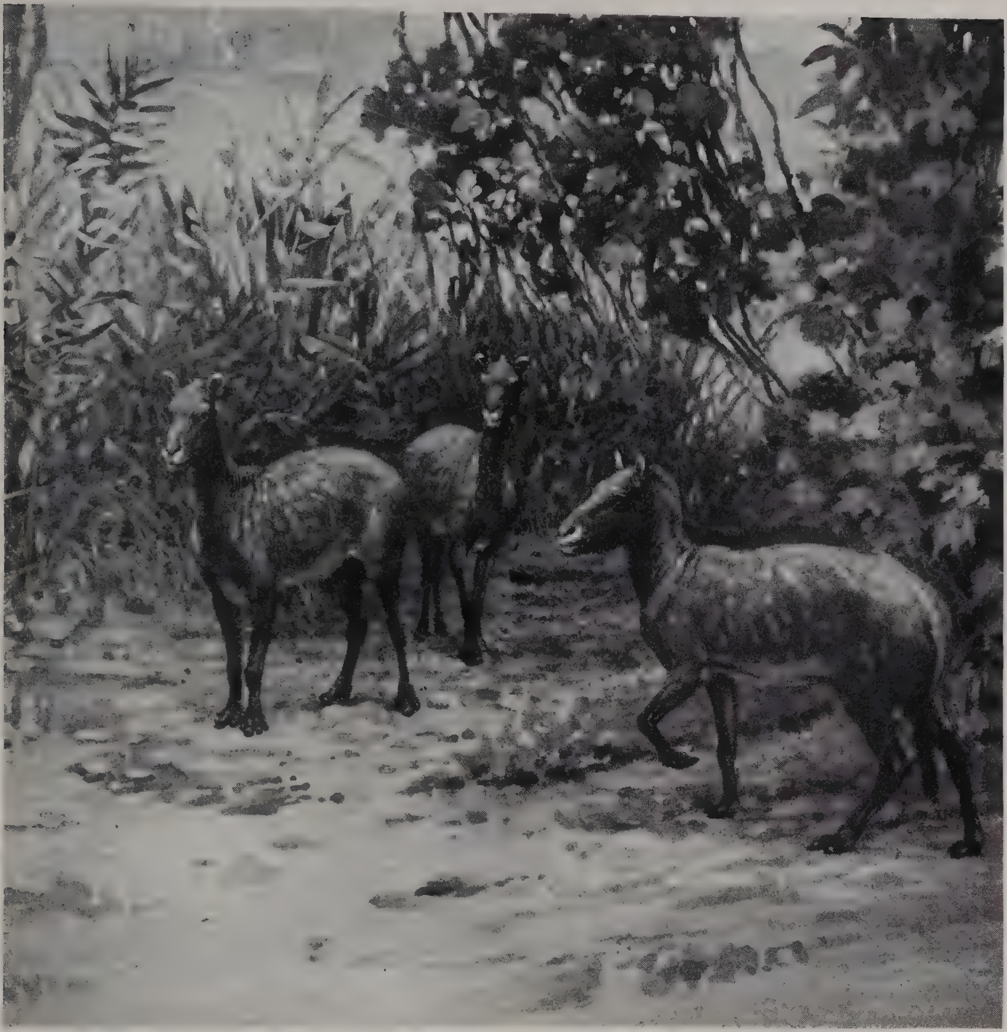
THEIR LIVING LIES BENEATH THE SNOW

Usually mountain sheep are exceedingly wary animals, but when winter snows bury their forage deeply they sometimes appear to lose most of their fear of man and permit a near approach.

falo. Buffalo, of course, being big and black, were impressive if seen in masses and were visible a long way off. Antelope, smaller and less conspicuous in color, were often passed unnoticed, except by a person of experience, who might recognize that distant white dots might be antelope and not buffalo bones or puff-balls.

"I used to talk on this subject with men who were on the Plains in the '60's and '70's, and all agreed that, so far as their judgment went, there were more antelope than buffalo. Often the buffalo were bunched up into thick herds and gave the impression of vast numbers. The antelope were scattered, and, except in winter, when I have seen herds of thousands, they were pretty evenly distributed over the prairie.

"I have certain memories of travel on the Plains, when for the whole long day one would pass a continual succession of



From a drawing by Charles R. Knight

PRIMITIVE MIDGET HORSES THAT ONCE LIVED IN WYOMING

The so-called four-toed horse was a little creature some 12 inches in height at the shoulder. He had four well-defined hoofs on the front foot and three on the hind foot. The animal is not a true horse, but was undoubtedly an ancestor (more or less direct) of the modern form. It must have been a very speedy type, which contributed greatly to the preservation of the species in an age when (so far as we know) the carnivores were rather slow and clumsy. This is the Eohippus of the Lower Eocene age.

small bands of antelope, numbering from ten to fifty or sixty, those at a little distance paying no attention to the traveler, while those nearer at hand loped lazily and unconcernedly out of the way. In the year 1879, in certain valleys in North Park, Colorado, I saw wonderful congregations of antelope. As far as we could see in any direction, all over the basins, there were antelope in small or considerable groups. In one of these places I examined with care the trails made by them, for this was the only place where I ever saw deeply worn antelope trails, which suggested the buffalo trails of the Plains."

The wealth of animal life found by our forbears was one of the great natural resources of the New World. Although freely drawn upon from the first, the stock was but little depleted up to within a century. During the last one hundred years, however, the rapidly increasing oc-

Photograph by George Shiras, 3rd

MULE DEER BUCK AND DOE ON KAIBAB PLATEAU, ARIZONA

One of the characteristic animals of the Rocky Mountain region and other parts of the West. Its antlers sometimes almost equal those of the elk in size and beauty.

cupation of the continent and other causes, together with a steadily rising commercial demand for animal products, have had an appalling effect. The buffalo, elk, and antelope are reduced to a pitiful fraction of their former countless numbers.

WANTON WASTE OF WILD LIFE PARTLY STOPPED BY LAWS

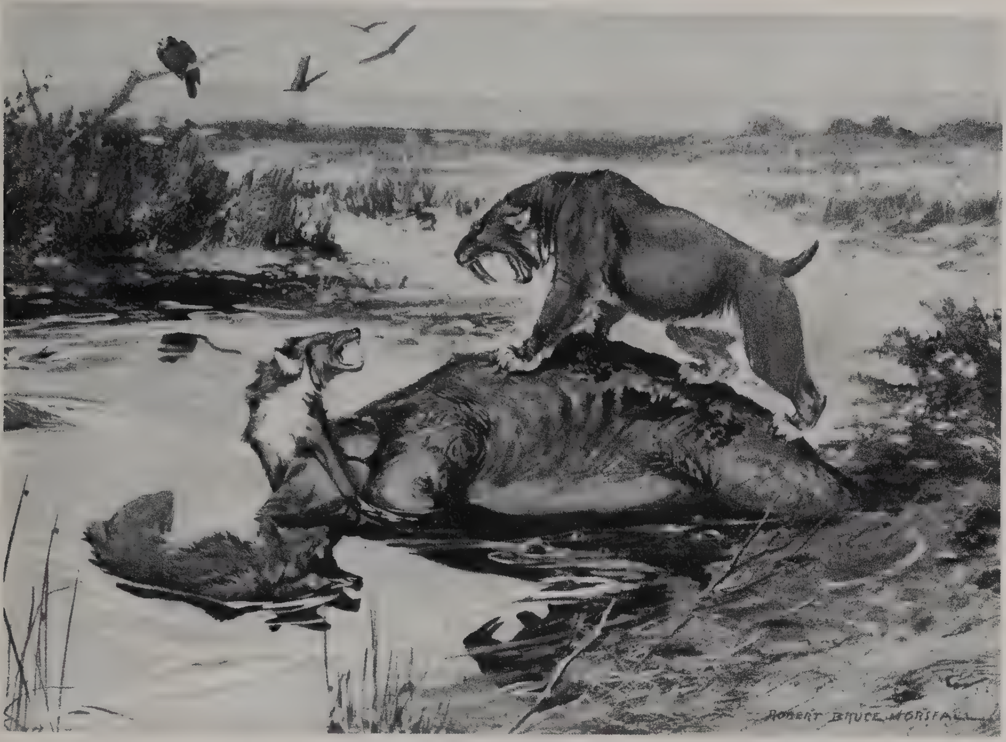
Practically all other large game has decreased alarmingly, and its extermination has been partly stayed only by the recent enforcement of protective laws.

It is true that the presence of wild buffalo in any region occupied for farming and stock-raising purposes is incompatible with such use. Thus the extermination of the bison as a denizen of our Western Plains was inevitable. The destruction, however, of these noble game animals by millions for their hides only furnishes a notable example of the wanton wastefulness which has heretofore largely characterized the handling of our wild life.

A like disregard for the future has been shown in the pursuit of the sea mammals. The whaling and sealing industries are very ancient, extending back for a thousand years or more; but the greatest and most ruthless destruction of the whales and seals has come within the last 75 years, especially through the use of steamships and bomb-guns. Without adequate international protection, there is grave danger that the most valuable of these sea mammals will be exterminated. The fur seal and the sea-elephant, once so abundant on the coast of southern California, are now represented by only a few hundred animals, and the sea otter of the North Pacific is gone from most of its former range and is dangerously near extinction.

COLUMBUS FOUND ONLY ONE DOMESTICATED ANIMAL IN AMERICA—THE DOG

The recent great abundance of large land mammals in North America, both in individuals and species, is in striking contrast with their scarcity in South America, the difference evidently being due to the long isolation of the southern continent from other land-masses, whence it might have been restocked after the loss of a formerly existing fauna.



From Scott's "History of the Land Mammals of the Western Hemisphere": Macmillan Company

ANCIENT DAYS AT THE CALIFORNIA ASPHALT PITS

Within the city limits of Los Angeles, the bones of thousands of extinct animals have been found representing many species. The soft asphalt formed a trap, like a quicksand, that swallowed everything going upon its surface. Among the bones found are many of the elephant, giant wolves, and saber-toothed tiger shown here (see text, page 3).

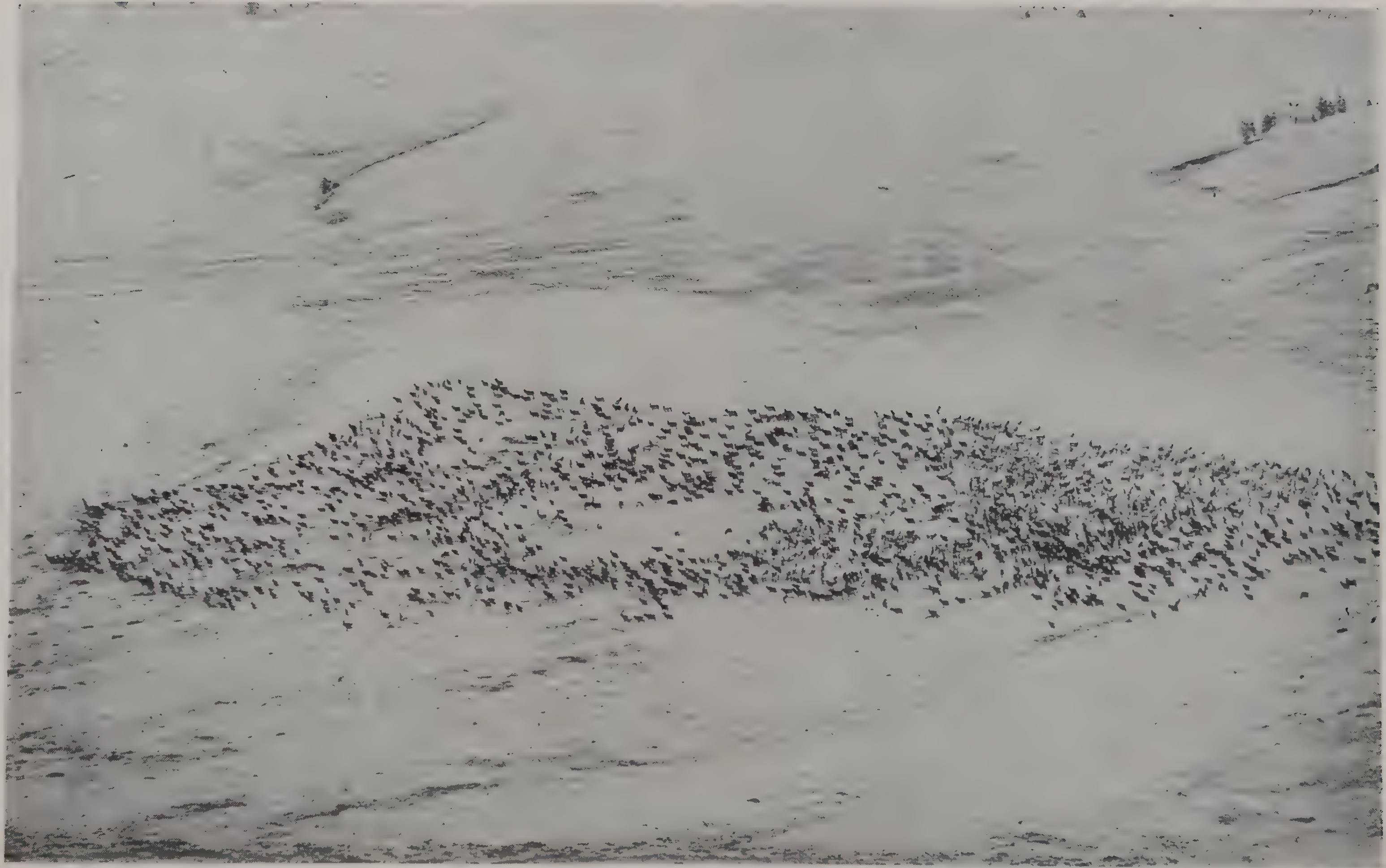
At the time of its discovery by Columbus, this continent had only one domesticated mammal—the dog. In most instances the ancestors of the Indian dogs appear to have been the native coyotes or gray wolves, but the descriptions of some dogs found by early explorers indicate very different and unknown ancestry. Unfortunately, these strange dogs became extinct at an early period, and thus left unsolvable the riddle of their origin.

Before the discovery of America the people of the Old World had domesticated cattle, horses, pigs, sheep, goats, dogs, and cats; but none of these domestic animals, except the dog, existed in America until brought from Europe by the invaders of the New World.

FEWER LARGE MAMMALS IN THE TROPICS

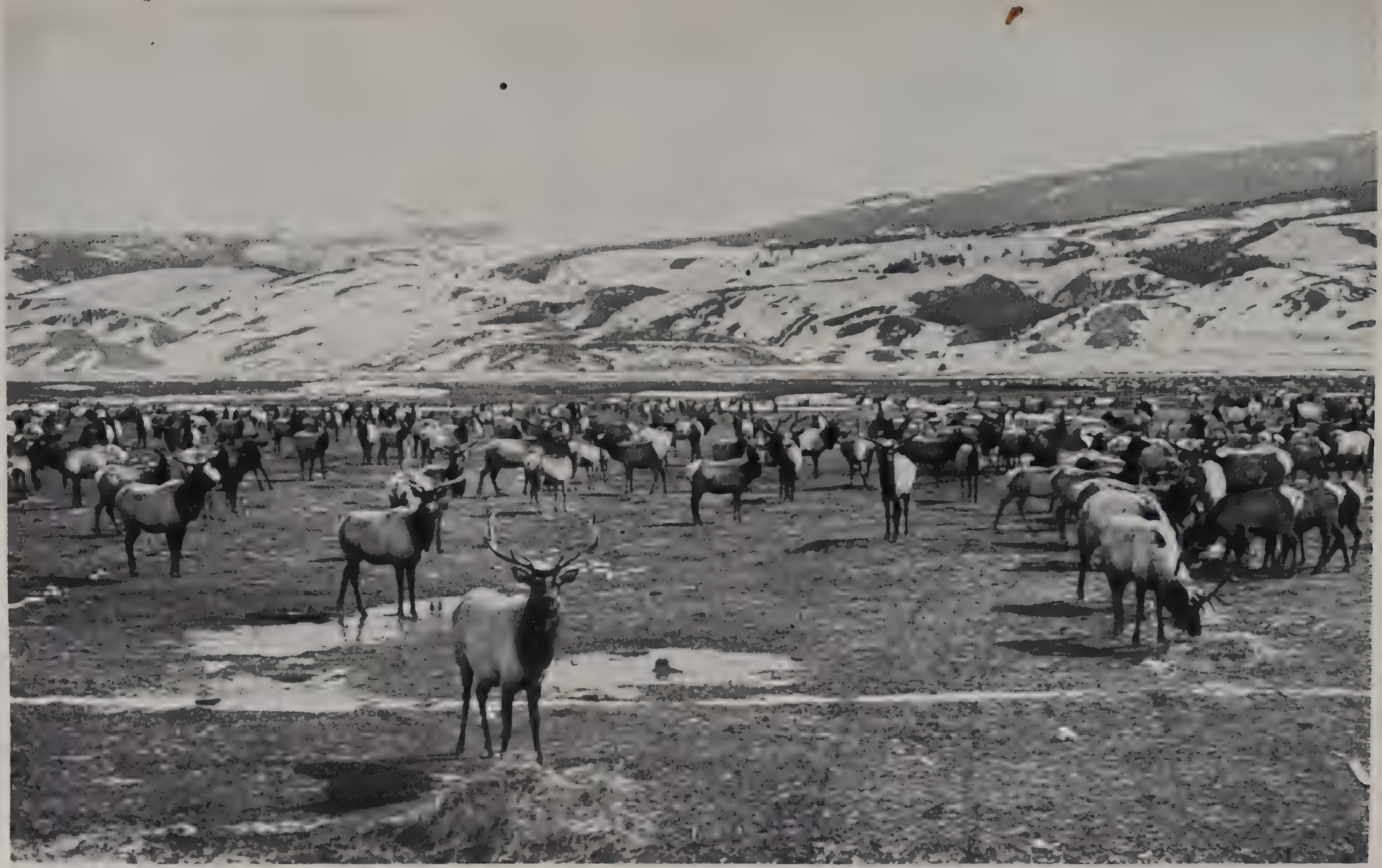
It is notable that the fossil beds which prove the existence of an extraordinary abundance of large mammals in North America at various periods in the past, as well as the enormous aggregation of mammalian life which occupied this continent, both on land and at sea, at the time of its discovery, were confined to the Temperate and Arctic Zones. It is popularly believed that the Tropics possess an exuberance of life beyond that of other climes, yet in no tropical lands or seas, except in parts of Africa and southern Asia, has there developed such an abundance of large mammal life as these northern latitudes have repeatedly known.

In temperate and arctic lands such numbers of large mammals could exist only where the vegetation not only sufficed for summer needs, but retained its nourishing qualities through the winter. In the sea the vast numbers of seals, sea-lions, walruses, and whales of many kinds could be maintained only by a limitless profusion of fishes and other marine life.



ON THE WINTER ELK REFUGE IN JACKSON HOLE, WYOMING

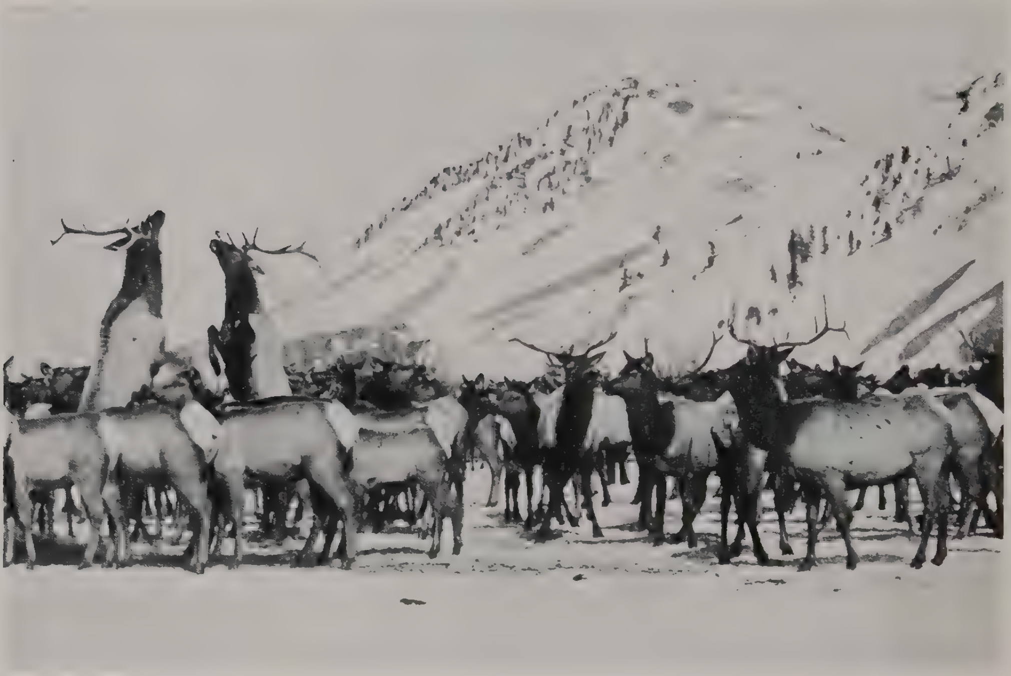
Elk thrive on the abundant vegetation provided by heavy rains in the high mountains in summer, but when driven down by the winter snows they find scanty forage in the lowlands now so generally occupied by farms and stock ranches. The two largest existing herds move north and south from the Yellowstone National Park at the approach of winter, and the Government provides hay to help them through the barren months that follow.



Photograph from U. S. Biological Survey

ON THE IZAAK WALTON LEAGUE ADDITION TO THE WINTER ELK REFUGE, WYOMING

As winter shuts down on the mountains the elk appear to lose nearly all fear of man and gather on the feeding places without alarm, as the men move among them. Back in the hills, however, they reassume their distrust. More than 10,000 elk also find sanctuary in Yellowstone National Park.



Photograph by S. N. Leek

ELK AT WAR

The favorite method of attack and defense of the elk is by blows delivered with the forefeet. Sometimes they strike out and down with one foot and again rear up and make a downward blow with both. A single blow from one front foot can break the back of a gray wolf.

From the earliest appearance of mammals on the globe to comparatively recent times one mammalian fauna has succeeded another in the regular sequence of evolution, man appearing late on the scene and being subject to the same natural influences as his mammalian kindred. During the last few centuries, however, through the development of agriculture, the invention of new methods of transportation, and of modern firearms, so-called civilized man has spread over and now dominates most parts of the earth.

DESTROYING THE IRRESTORABLE

As a result, aboriginal man and the large mammals of continental areas have been, or are being, swept away and replaced by civilized man and his domestic animals. Orderly evolution of the marvelously varied mammal life in a state of nature is thus being brought to an abrupt end. Henceforth fossil beds containing deposits of mammals caught in sink-holes, and formed by river and other floods in subarctic, temperate, and tropical parts of the earth, will contain more and more exclusively the bones of man and his domesticated horses, cattle, and sheep.

The splendid mammals which possessed the earth until man interfered were the ultimate product of Nature working through the ages that have elapsed since the dawn of life. All of them show myriads of exquisite adaptations to their environment in color, form, organs, and habits. The wanton destruction of any of these species thus deprives the world of a marvelous organism which no human power can ever restore.

Fortunately, although it is too late to save many notable animals, the leading nations of the world are rapidly awakening to a proper appreciation of the value and significance of wild life. As a consequence, while the superb herds of game on the limitless plains will vanish, sportsmen and Nature lovers, aided by those who appreciate the practical value of wild life as an asset, may work successfully to provide that the wild places shall not be left wholly untenanted.

Although Americans have been notably wasteful of wild life, even to the extermination of numerous species of birds and mammals, yet they are now leading the world in efforts to conserve what is left of the original fauna. No civilized people, with the exception of the South African Boers, have been such a nation of hunters as those of the United States. Most hunters have a keen appreciation of Nature, and American sportsmen as a class have become ardent supporters of a nation-wide movement for the conservation of wild life.

SAVING OUR WILD LIFE

Several strong national organizations are doing great service in forwarding the conservation of wild life, as the National Geographic Society, the National Association of Audubon Societies, Boone and Crockett Club, Izaak Walton League, American Game Protective and Propagation Association, and others. In addition, Federal and State governmental organizations and a large number of unofficial State organizations have been formed to assist in this work.

Through authorization by Congress, the Federal Government is actively engaged in the protection and increase of our native birds and mammals. This work is done mainly through the Bureau of Biological Survey of the U. S. Department of Agriculture, which is in charge of enforcement of Federal game laws and of Federal large-game preserves and more than 80 bird reservations. The National Park Service is also safeguarding wild life on a great scale in the national parks, and the U. S. Forest Service is working for the same object.

On the large-game preserves are herds of buffalo, elk, deer, and antelope. The Yellowstone National Park is one of the most wonderfully stocked game preserves in the world. In this beautiful tract of forest, lakes, rivers, and mountains live many moose, elk, deer, antelope, mountain sheep, black and grizzly bears, wolves, coyotes, mountain lions, and lynxes.

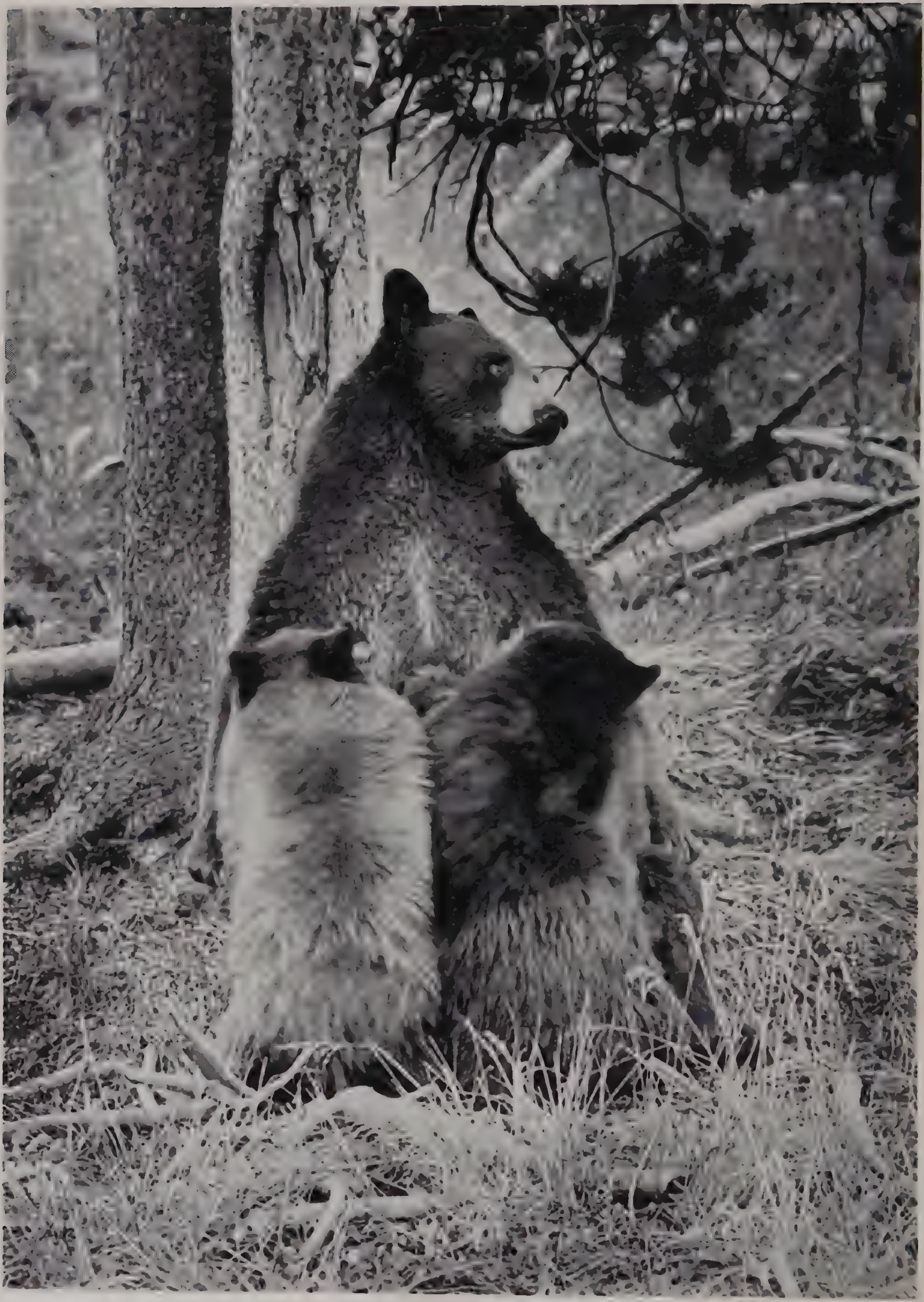
Practically all of the States have game and fish commissions in one form or another, with a warden service for the protection of game, and large numbers of State game preserves have been established. The increasing occupation of the country, the opening up of wild places, and the destruction of forests are rapidly restricting available haunts for game. This renders particularly opportune the present and increasing widespread interest in the welfare of the inhabitants of the wilderness.

The national forests offer an unrivaled opportunity for the protection and increase of game along broad and effective lines. At present the title to game mammals is vested in the States, among which great differences in protective laws, and in their administration, in many cases jeopardize the future game supply.

HOW STATES AND THE NATION MAY COÖPERATE

Probably the most effective means of assuring the perpetuation of our splendid big-game animals within the United States would be by the closest coöperation between the States and the Department of Agriculture. In the national forests, covering so much of our remaining big-game territory, the department could protect the game and each year report to the States the districts in which surplus animals exist, and the approximate number that could be taken of each kind without endangering the future supply. The States could make the hunting seasons and issue restricted hunting licenses in accordance with the number of available animals.

Under such an arrangement the game supply would be handled on business principles. If game becomes scarce in any restricted area, hunting could be suspended until the supply is renewed, while increased hunting could be allowed in areas where there is sufficient game to warrant it. In brief, big game could be handled by the common-sense methods now used so effectively in the stock industry on the open range. At present the lack of a definite general policy to safeguard our game supply and the resulting danger to our splendid native animals are deplorably in evidence, save in a few exceptional States.



© F. J. Haynes

"BABES IN THE WOOD"

The American black bear is not aggressive and will attack man only when wounded or in defense of its young. These hungry twins were born in midwinter and came into the world entirely devoid of fur overcoats, which soon developed, however. In a month their eyes were open, and in two months they were following their mother about the great forests of the Yellowstone National Park, where 450 of their kind find protection.

CHAPTER II

The Smaller Mammals and Their Ways

THE muskrats, minks, martens, and skunks for many years have yielded an enormous annual return from their furs; the squirrels and rabbits afford sport and a large supply of excellent flesh for food; the prairie dogs and some of the ground squirrels existing in enormous numbers have been excessively destructive to crops; and others, like the porcupine and the armadillo, have attracted particular attention because of their strange characteristics.

The smaller mammals live everywhere, from the subtropical end of Florida to the uttermost lands of the frozen North, and from the seashore to the limit of vegetation on the high mountains. The heaviest forests, open meadows, rugged mountain slopes, Arctic Barrens, and sun-scorched desert plains all have their small four-footed inhabitants. Many modifications of parts and organs of the various species have been necessary to adapt the small mammals to specialized modes of life.

This is strikingly illustrated in the case of those true rodents, the pocket gophers, which apparently found competition on the surface of the ground so acute that they took the unoccupied territory below the surface, where they live as miners and tunnel from place to place in search of edible roots, with an occasional stealthy excursion above ground to seize some of the food available there.

Another excellent illustration is furnished by the moles, which, leaving the numerous closely related species—the shrews—to feed upon insects above ground, have descended and, like the pocket gophers, live in tunnels which they make in the pursuit of earthworms and insects below the surface; like the gophers, they, too, make occasional excursions above ground in search of food.

A DEPARTURE FOR EVERY NEED

The mink and the muskrat, representing the carnivores and rodents, have rivals for their food supply on land and have become amphibious, being as much at home in the water as on shore, one feeding on fish and flesh and the other on aquatic vegetation. Certain forms of the squirrel tribe are heavy-bodied and live in underground burrows, while other more slender and graceful species make their homes in the tree-tops.

Another member of this group, the flying squirrel, has developed an extension of the skin uniting the front and hind legs, so it may glide freely from tree to tree. The bats have gone still further, and the skin uniting their lengthened front and hind limbs and long finger bones forms broad wings which lend them powers of flight scarcely equaled by those of birds.

The gophers, pocket mice, chipmunks, and others are provided with little cheek pouches in the skin on each side of the mouth, in which they may carry food home to their storerooms and other hiding places.

The hares have developed long legs for running on open plains, and the weasels have long, slender bodies and an exceeding quickness, which enable them to follow and capture their elusive prey in its burrows and among crevices in the rocks.

The hairy coat of the mole is short and equal to the finest velvet, while that of the porcupine stands out in strong, sharp spines; the skin of the armadillo is practically hairless, but forms a bony armor covering its upper parts.

The front feet of squirrels and most other rodents are slender and used with deftness as hands in manipulating food, while those of the badger and skunk are heavily clawed and strongly muscled for the purpose of digging up their prey.

STRANGE ADAPTATIONS TO MEET ENVIRONMENT AND COMPETITION

The tails of many species are varied in form to serve special purposes. The long-haired tails of tree squirrels have a plumelike character, which adds much to the beauty of these attractive animals. The long tails of the kangaroo rats and the jumping mice serve as balances for their bodies during long leaps. The vertically flattened tail of the muskrat and the broad, horizontally flattened tail of the beaver are useful as rudders. Perhaps the oddest of all is the naked prehensile tail of the opossum, which coils about branches or other support and thus is a

Photograph by F. O. Seabury

PART OF A HERD OF SIXTY ROCKY MOUNTAIN SHEEP

They were fed hay and salt daily during winter at the Denver and Rio Grande Railway station at Ouray, Colorado. The picture was taken at a distance of about 10 to 15 feet from the wild animals, which grew quite tame under such friendly ministrations.

safeguard against a possible fall, and even permits the animal to hang suspended by it alone.

In such ways, by thousands of adaptations and modifications of the typical four-footed mammal, are they fitted to their varied modes of life, each so far as possible in some special place of its own.

The effect of the pressure of environment and competition upon the various species of mammals in any region could not be better shown than by the kangaroos of Australia. That continent is occupied by many species of these peculiar mammals, some of which inhabit the open plains like our jack rabbits in the West; others have learned to climb and live arboreal lives in the tree-tops; and still other members of this group have become burrowers and live in dens underground like some of our native rats and mice.

From the instances mentioned above, it is obvious that the mammalian organism is very plastic and has been molded by the environment to which it has been subjected during the ages. The larger effects evidenced by profound modifications in the anatomy are the result of continued pressure extending far back in time. The far more numerous, modern, and superficial changes known to naturalists as geographic variations are to be seen everywhere.

GEOGRAPHY AFFECTS AN ANIMAL'S COLOR

By the collection of great series of specimens in North America and elsewhere in the world, it has been proved that it is common for a single species of mammal to occupy a great area, including such diverse climatic conditions as humid forested districts near sea level, sections of arid desert plains in the interior, and high rugged mountain slopes. In each area of differing conditions it is ordinarily found that representatives of a species, under certain conditions, vary from those in other areas mainly in shades of color and in proportions.

In arid areas the colors are usually distinctly paler and grayer, in the humid districts they are darker and browner. Other conditions also effect these changes among members of the same species, as is shown in some of the most arid and desert plains of the southwestern United States, where mammals living among dark-colored lava beds are darker than those found, sometimes within a few rods, on paler

A TRUE HORSE WHICH WAS FOUND IN THE PLEISTOCENE FOSSIL BEDS OF TEXAS

It is interesting to note that this country once had several species of wild horses, but these died out long before the advent of the Indian on this continent. The present wild horses of our Western plains are merely stragglers from the herds brought over by the Spaniards and other settlers. When Columbus discovered America there were no horses on the continent, though horses and camels originated here (see text, page 5, and illustration, page 9).

adjoining soil. Complete isolation under the same climatic and other conditions sometimes produces marked changes, as is well illustrated by the difference between the Abert and Kaibab squirrels on the two sides of the Grand Canyon in Arizona.

The different forms of a species occupying areas under varying conditions are commonly termed "geographic races." They grade imperceptibly into one another along the border between their ranges, step by step with the gradations of the climatic and other conditions which have produced their differences.

ANIMAL CHEMISTS CHANGE STARCH INTO WATER

One of the most striking modifications of mammalian economy by environment is that shown in many small mammals of our southwestern desert region and adjacent parts of Mexico, in which such species as the kangaroo rats, pocket mice, prairie-dogs, and others are able to exist under the most arid conditions without drinking. The liquid necessary for supplying their bodily needs is obtained through chemical action in their digestive tracts, whereby some of the starchy parts of their food are changed into water.

Over considerable areas in the waterless deserts on the peninsula of Lower California periods of from three to five years sometimes pass without a drop of rain falling. In these areas the small desert mammals named above, as well as wood rats, white-footed mice, cottontails, and jack rabbits, are numerous and successfully pass these dry periods without inconvenience. The absolute independence of water of these animals has been demonstrated in southern California in the case of pocket mice kept for months in captivity in a box and fed solely upon thoroughly dried seeds without their showing the slightest sign of discomfort.

GNAWERS ARE THE MOST NUMEROUS OF MAMMALS

Our small mammals may be roughly classified by their food habits into three main groups: rodents, or gnawing animals; carnivores, or flesh eaters, and insectivores, or insect eaters.

© Howard S. Adams

SIX RED FOX CUBS CAPTURED IN CANTON, MASSACHUSETTS

The grouping was difficult, as the young animals were very shy, and a number of attempts were made before this photograph was obtained. The adaptability of the red fox to maintain itself in New England and elsewhere in the Eastern States is proof of its mental acuteness.

The rodents vastly outnumber all other mammals and are typified by the squirrels, rats, and mice; their food is mainly vegetable matter, but many of them eat insects and meat whenever available. The carnivores, including such species as the weasel, mink, and marten, are mainly flesh eaters, preying largely upon rodents, but they also eat insects and fruits of many kinds. The insectivores include the moles and shrews, which, with all the bats found within our limits, are almost exclusively eaters of worms and insects.

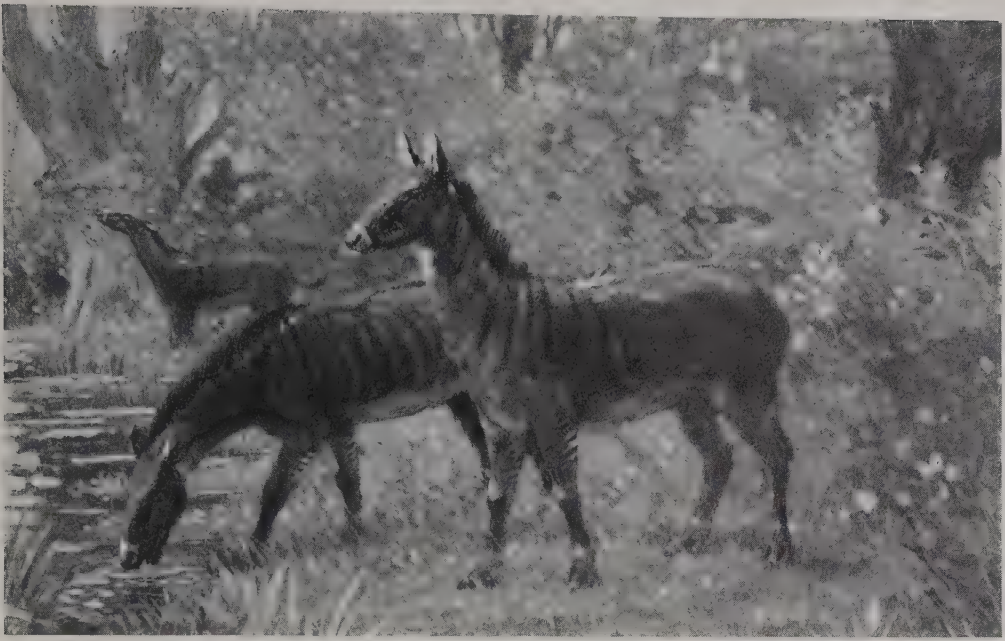
While rodents primarily feed on vegetable matter, it is surprising to note the large number of species among them which commonly feed on insects and have strong carnivorous propensities. This is not so much the case with such larger rodents as the beaver, porcupine, and woodchuck, but most of the smaller kinds, from squirrels to mice, have been found to be confirmed flesh eaters.

The destruction of the eggs and young of birds, both on the ground and in the trees, by these animals must have a far-reaching effect in reducing the number of insectivorous and other small birds. Some small rodents, like the grasshopper mice, subsist mainly upon insects and flesh.

The naturalist who sets traps for small rodents in field or forest is constantly annoyed by finding trapped animals partly devoured by their fellows. When mice or rats are confined together in cages and provided with an abundance of vegetable food, it is a common experience to find that the stronger kill and eat the weaker ones, until in a short time only a single survivor remains. These cannibalistic traits are strongly developed in the common house rat, which is notorious for its savagery toward others of its kind.

CASES OF CONCENTRATED FEROCITY

To a certain extent the ferocity of mammals appears to increase in proportion to a decrease in their size. The smaller members of the weasel family—the weasels—



From drawings by Charles R. Knight

THE FOREST HORSE OF NORTH AMERICA (HYPOHIPPUS MIOCENE)

The Hypohippus of Miocene times is supposed to have inhabited heavy undergrowth. It was somewhat off the true horse ancestry and had three rather stout toes on both the fore and hind feet (see, also, illustration, page 9).

are relatively far more active and bloodthirsty than the minks, martens, and other larger members of the group.

If the common weasel should be increased to the bulk of a mountain lion and retain its nature and physical prowess, it would be many times more dangerous than any existing carnivore and the devastations it would commit would be appalling. Even the tiny insect-eating shrews are endowed with a fierce and aggressive spirit scarcely equaled among larger animals.

Rodents and insectivorous mammals are without effective weapons of offense or defense against the birds and beasts of prey which beset them. Many, however, are surprisingly courageous when brought to bay, and, using their front teeth, will fight to the death with vigor and spirit. This is especially true of the muskrats and their cousins, the field mice. Carnivores, both great and small, have teeth and claws with which to defend themselves against attack.

In addition, skunks have an even more potent weapon in the secretion of a vile-smelling liquid which is sprayed on a dangerous enemy. So confident are skunks in the efficacy of this weapon that they are extremely calm and unhurried in their manners and take little trouble to avoid an encounter with man or beast. Their odoriferous weapon is not used among themselves, however, but appears to be held for service against more dangerous enemies.

Scent glands are common among rodents, carnivores, and insectivores, but are ordinarily used for purposes of communication with others of their kind, sometimes to attract the opposite sex and sometimes merely to give notice of their presence in a locality.

The hard school of experience holding through the ages has taught many of our rodents the necessity of laying in stores of food to meet periods of scarcity. Many species store food in a desultory way whenever a surplus is available, but when harvest time comes, at the close of summer, the work is taken up as a serious occupation during many busy hours each day or night by the species living where the severe northern winters make the stores a necessity.

The storage instinct is possessed as well by many of the southern desert species, where climatic conditions permit activity throughout the year. In such regions the supplies serve during storms and in periods of drought, when the yield of plant food is limited.

GOOD HOUSEKEEPING IN RODENT LAND

One can but marvel at the wise prescience with which northern rodents gather their winter stores and hide them away safe from the weather in secret places in hollow trees, old logs, crevices among the rocks, or in neat storage chambers dug for the purpose adjoining underground burrows. The size of the stores and the tireless industry of these little husbandmen in gathering them might well serve as examples worthy of emulation by some of their human neighbors. The seeds gathered are freed from chaff, the grasses and herbs are dried as "hay," and roots are carefully cleaned before being stored.

The storing habit appears to be nearly always for purely individual benefit. The food is usually stored in bulk, but squirrels and chipmunks often bury here and there single nuts, which they are able to recover long afterward through their extraordinary powers of smell.

Stores are laid by for a single season, and a single failure of a nut or seed crop will cause the starvation of many small animals, and the failure of the crops for two or more seasons is so disastrous that the rodents may nearly or quite all die of famine over great areas. The reverse of this occurs during successive years of bountiful nut and seed crops.

An abundant food supply appears to be a powerful stimulant to the fecundity of mammals, and the number of young at a birth, as well as the number of litters born during a season, are greatly increased by it, until their haunts fairly swarm with them.

THE EBB AND FLOW OF RIVAL SPECIES

With this stimulated increase of rodent life goes a related increase in the number of birds and mammals which prey upon them. The close relationship between the numbers of rodents and of the carnivores which prey upon them is shown by the records of the Hudson's Bay Company, in which, with the increase or decrease in the abundance of varying-hare skins secured by the fur traders, goes a corresponding increase or decrease in the number of lynx skins taken.

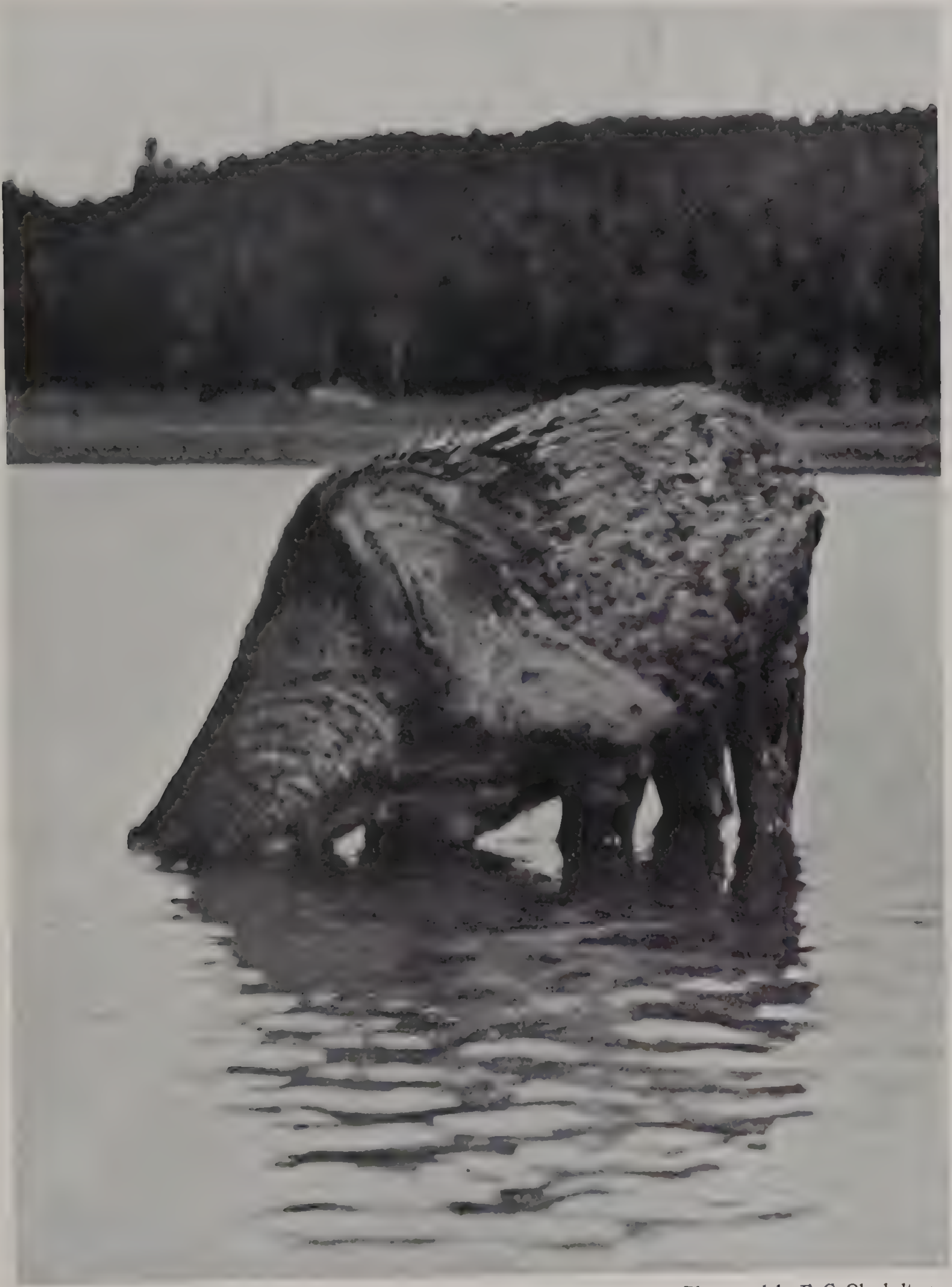
After rodents become enormously abundant, if food becomes scarce they sometimes make extended migrations, during which vast numbers swarm across the country, like the lemmings of the North or the gray squirrels during their historic migrations of early days in the eastern United States. At such times vast numbers of the wandering hordes perish; epidemic disease also plays its part in reducing their numbers. Nature thus is self-limiting in restraining the permanent increase of any species beyond the numbers needed to preserve its balance.

The advent of man in new regions with his clearing of forests, cultivation of the soil, and destruction of animal life for food or other purposes, quickly upsets the balance of Nature, and some species are much reduced in numbers or disappear, while others, especially among the smaller kinds of mammals, may greatly benefit through added food supplies, and then increase until they become a pest, to be destroyed by the farmer as a measure of self-protection.

ANIMALS THAT SEEK SAFETY IN DARKNESS

For some reason, perhaps owing to their small size and defenselessness against birds and beasts of prey, the great majority of small mammals, including hundreds of species and untold millions of individuals, are nocturnal or live such obscure and hidden lives that they are unknown except to the comparatively few people who go much afield, with all their powers of observation alert by day and by night. Many of the mainly nocturnal species pursue minor activities by day, where shelter of one kind or another gives them a reasonable feeling of security.

Under the revealing light of day most small mammals, especially the rodents, are extremely watchful and timid, leading lives filled with alarms which commonly end in tragic deaths. By night they appear to have far greater confidence; yet this also is a time of imminent danger from the owls and many beasts of prey then prowling about.



Photograph by E. C. Oberholtzer

MOOSE FEEDING UNDER DIFFICULTIES

Succulent water plants grow on the bottoms of lakes and sluggish streams, where the moose sometimes feeds at a depth of eight feet or more and often becomes completely submerged.

Photograph by L. Peterson

INTRODUCING A LITTLE BLACK BEAR TO A LITTLE BROWN BEAR AT SEWARD, ALASKA

"Howdy-do! I ain't got a bit of use for you!"
"What do I care! You'd better back away, black bear!"

That the small rodents have good cause for their timorous ways is plain when we consider the array of enemies which encompass them, including owls, herons, gulls, bears, foxes, bobcats, weasels and their cousins, with snakes, and on occasion fishes, which take endless toll from their numbers. Fortunately for them, these small folk live wholly in the present and quickly forget the shadow of death cast by the passage of a hawk or the skulking form of a four-footed enemy.

COUNTLESS BEASTS ROAM THE NIGHT

By day the squirrels, chipmunks, woodchucks, and spermophiles are abroad and unite with the birds to lend an air of pleasant animation to forest and plain. With the falling shades of night, near the abodes of mankind as well as in the remote wilderness, everywhere a countless multitude of small beasts comes forth and forms a little, bright-eyed furry world, clad in delicate shades of gray and brown and characterized by remarkable grace and agility.

These small folk of the night swarm out from snug nests hidden in burrows in the earth, in crevices among the rocks, in hollow trees, under logs or other cover, and even from the shelter afforded by buildings. In number and variety of forms they far exceed anything seen by day. The air is filled with the flitting forms of bats, while among the trees or on the ground, varying with the locality, are multitudes of rabbits, flying squirrels, rats and mice of many kinds, lemmings, pocket mice, kangaroo rats, pocket gophers, shrews, and even moles.

This profusion of night life brings forth the prowling powers of darkness in the form of velvet-winged owls, weasels, skunks, minks, martens, and other carnivores, which by scent and by keen vision find abundant harvest. The small carnivores, in turn, are subject to the predatory law of might and are at times hunted by the larger carnivores, as the great-horned owls, the wolves, foxes, fishers, bobcats, and mountain lions.

To most people the majority of small rodents are classed as "rats" or "mice" and are viewed with the prejudice born of long familiarity with those omnipresent pests, the house rats and mice. The small beasts of field and forest are commonly of remotest kinship to these repulsive household parasites and are of entirely different lineage, having nothing in common but their size.

ANIMAL INTELLIGENCE AKIN TO MAN'S

When viewed with unbiased attention, these little animals of the wilds are certain to charm the observer either by their beauty and grace or by their varied and interesting habits. No one can long study mammals, large or small, without observing many traits of intelligence so akin to one's own that they awaken feelings of fellowship.

The modes of life of small mammals are much more varied than those of the larger species. At times radical differences in habits may be noted among the individuals of the same species, as instanced by the wood rats of Santa Mar-

Photograph by E. C. Oberholtzer

A COW MOOSE WITH HER YOUNG

In northern Minnesota and elsewhere in its range, the constant torment of swarms of flies, combined with the suckling of their young, often render cow moose much emaciated. At that season they frequent small lakes both to feed on the water plants (see page 23) and for protection from their insect enemies.

garita Island, Lower California, some of which live in burrows dug by themselves in the ground and others in nests built of sticks in the tops of mangroves rising amid the waters of a lagoon.

An even more extraordinary variation is shown among the heavy-bodied meadow mice of the genus *Phenacomys,* most of which live in underground burrows; but one member of the group in Oregon builds its nests in the tops of tall conifers, sometimes at an altitude of 80 feet, and rarely or never descends to the ground.

PEEPS INTO FUR-FOLK HOMES

The homes of small mammals vary greatly. The species living in underground burrows usually excavate an oval chamber which is filled with fine vegetable material to form a snug retreat. The muskrat places a conical lodge on the border of a marshy stream or lake. The wood rat lives in an underground burrow, in a nest of sticks and trash heaped above the ground or in a stick nest placed among the branches of low trees. Harvest mice build a little hollow ball of grass blades, lined with finer material, among the branches of bushes several feet above the ground. White-footed mice may lodge in a knothole 50 feet or more above ground in the trunk of a tree.

As a rule, small mammals are of inconspicuous colors which harmonize so well with their surroundings that when not in motion, especially if lying close to the ground, they are difficult to distinguish. Exceptions to this rule are obvious in the case of jack rabbits when standing on bare plains, or other mammals which have

Photograph by Albert Schlechten

A CINNAMON TREED: YELLOWSTONE NATIONAL PARK

Bruin, for the most part, is an inoffensive beast, with an impelling curiosity and such a taste for sweet things that he can eat pounds of honey and lick his chops for more. The cinnamon bear is not a distinct species, but merely a color phase of the black bear (see, also, illustration, page 16).

ventured out from the usual partly concealing growth of vegetation or other surroundings.

In contrast to the protective coloration are certain markings, like the cottony white underside of the tail of the cottontail rabbit, which renders the flight of this animal conspicuous in the gloomiest shades of the forest, or even on the approach of night, when it is impossible to distinguish the animal itself. The white underside of the tail of the antelope chipmunk is another well-defined instance of this kind.

The most marked of all examples of "directive" coloration among the small mammals appears to be that of certain white-sided jack rabbits, in which the white areas on the sides and rump are drawn up and down as the animal runs, giving a flashing effect, which attracts attention to them exactly as does the white rump-patch of the antelope.

NEW COATS FOR BOREAS'S COURT

In the northern part of the continent, where snow lies for many months, several species of hares are dusky or buffy gray in summer and change to a pure-white coat in winter. This change is of enormous protective value to these animals. In Greenland, where the summer is short and snow exists throughout the year, the highest northern representative of the hares remains permanently white, while near the southern border of snow in the United States the varying hares and white-tailed jack rabbits, which become pure white in the northern parts of their range, make only a partial change.

Weasels are the only carnivores which change from the brown of summer to a white winter coat. Owing to their small size and the need for activity in the snowy northern regions, where they would be peculiarly susceptible to danger from birds of prey and larger predatory animals, their protective white coats serve them well.

It was formerly considered that the change of mammals from the brown of summer to the white winter coat in the fall, and from the white to the brown in spring, was due to a change in the color of the hairs, but it is now known that it is entirely due to molt. The time of these changes depends on the season, and this varies several weeks, according to whether the fall or spring is early or late.

The general shades of mammals are of delicate tints, and the spots, stripes, and other markings, as in the case of chipmunks and the little spotted skunk, are often of great beauty.

SOME SQUIRRELS AND MICE ARE SONGSTERS

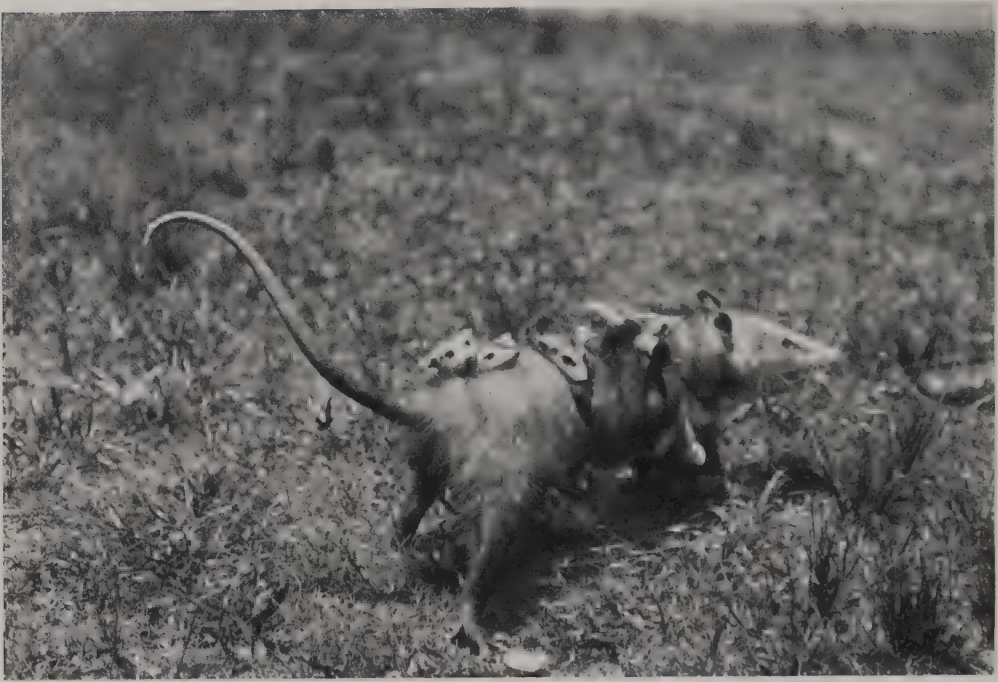
Small mammals vary greatly in their vocal powers, but the changes in intonation and character of the notes and calls indicate plainly that they are used to convey a variety of meanings.

Some are practically voiceless, as in the case of rabbits and hares, except when in an extremity of fear they utter loud shrieks of terror. Squirrels, prairie dogs, and some other small mammals bark and chatter, while mice and bats have a variety of curious squeaking notes. Marmots and ground squirrels have chattering notes and sharp, whistling calls.

In addition, some of the squirrels and many mice are known to have continuous series of notes which are as evidently songs as the utterances of birds. Some of these notes, as in the case of singing mice, have a remarkably musical character, similar to the warblings of canaries. Various unrelated species of mice have been observed singing, and a closer study of the life habits of these small animals may develop the fact that all are songsters to some degree.

House rats and mice have, undoubtedly, been parasitic about the haunts of man from early times. From Asia they have accompanied him through his advance in civilization. With the growth of commerce they have traveled around the world, becoming transplanted to all lands and thriving in all climates. In various parts of America they have not only become pests about human habitations, but where climatic conditions were favorable they have reverted to the wild state and are competing with the native species in the fields.

Of all the small mammals none have become modified to such an extent as the bats. As a group these mammals are of world-wide distribution except in the inhospitable Polar regions. They are true mammals and present an extraordinary



Photograph by C. E. Walter

OPOSSUM WITH A LITTER OF TEN

This mother was found on the streets of Pascagoula, Mississippi, taking an early morning stroll with her babies.

variation in size, from tiny little creatures, almost as small and fragile as butterflies, to the huge fruit bats, with a spread of wing like that of a wild goose.

The heads of bats are strangely sculptured, some being smoothly contoured and shaped like those of little foxes; others appear like miniature bulldogs; and still others have curious cartilaginous nose-leaves upright on the muzzle. Some have the entire face molded into a hideous mask repulsive to look upon.

Their habits are equally varied to meet special conditions. Some are eaters of fruit alone; others feed solely upon insects, while others bite other mammals, including man, for the purpose of drinking the oozing blood, upon which they subsist. All are nocturnal, but some appear late in the afternoon, before the sun sets; most species, however, wait until the shades of night have covered the earth.

Throughout the world the majority of the species of bats feed upon insects, but there are many fruit-eaters. The teeming insect and plant life of the Tropics affords a never-failing food supply, and the center of abundance of these animals is found there. In some localities between 20 and 30 kinds of bats exist, with such vast numbers of individuals that the bat population far outnumbers all other kinds of mammals combined.

ANIMALS THAT SEEK COLD STORAGE

In the northern parts of the Old and New Worlds many mammals, including bears, marmots, prairie dogs, ground squirrels, and jumping mice, pass a large part of the winter months in a lethargic sleep called "hibernation." While hibernating these animals have extremely slow and slight heart action and their bodily temperature falls far below the normal of their active periods. During the most profound hibernation an animal may be awakened if brought into a warm temperature, but when again put into the cold it at once returns to sleep.

Preparatory to this sleep, during the summer and in the autumn, the hibernating mammals become exceedingly fat.

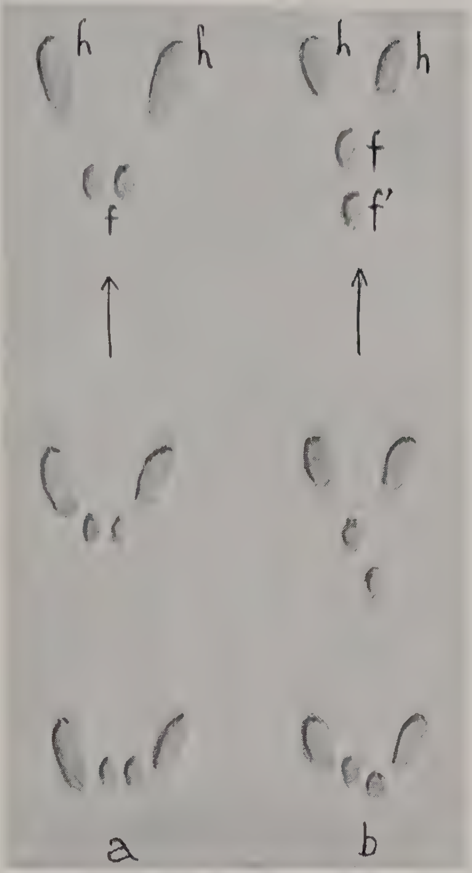
It has long been generally accepted that the fat thus accumulated was for the purpose of being gradually absorbed to nourish the animals during their long fast. As a matter of fact, during this period the bodily functions appear to be practically suspended and the animals may be said to be in cold storage. This is evident from the fact that observations have been made of ground squirrels, and even bears, emerging in spring, after their long winter sleep, practically as fat as when they retired in the fall. Hibernating animals become extremely active as soon as they come out in spring and quickly lose the fat which should be of special service to them, owing to the temporary shortage of food they experience at this season.

Most hibernating species do not retire for the winter until cold weather is at hand, in September or October, at times remaining out until after the first snow has fallen. The animals which retire latest, like chipmunks and prairie dogs, sometimes appear temporarily during certain warm periods in winter.

Recent observations have established the fact that the adults of both sexes of the Richardson ground squirrel living in the Northwestern States and adjacent parts of Canada become excessively fat by the first of July, and before the first of August practically disappear for the season, not appearing again until they emerge the following March or April. The retirement of these squirrels for a part of the summer is a case of imperfect "estivation," as it is termed, followed by complete hibernation. The young of the year enter hibernation at a later date.

A great number of both large and small mammals live solitary lives except for brief periods during the mating season or the association of the young with the mother. Some species, however, like the wolves and coyotes, may mate permanently and show great mutual affection and constancy. Many species have well-developed social instincts, which appear to combine two purposes, self-defense and the desire for companionship.

Herds of large herbivorous mammals, such as musk oxen and buffalo, frequently present a solid array of bristling horns to the attacking wolves, and thus protect the weaker members of the herd and give an example of the usefulness to them of the social instinct. Wolves and some other predatory animals hunt in couples or in packs and succeed in pulling down prey which singly they could not attack.



FOOTPRINTS OF NATURE'S WILD FOLK

BY ERNEST THOMPSON SETON

In the drawings reproduced on succeeding pages in this volume I usually give the track of a normal adult animal in about one inch of snow, that being ideal for tracking. Some of the smaller kinds are shown in fine dust. The trail goes up or across the page at the ordinary gait of the animal. The scale is indicated, but when possible the topmost set is given of life size. While there are endless variants in each kind, I aim to give the reader at least one typical set of each.

In all animals which bound, the hind feet track ahead of the front ones. This is very plainly seen in the rabbits. There are two arrangements of the forefeet when bounding: that of the rabbit (*b*), in which the forefeet are usually one behind the other, and that of the tree squirrel (*a*), in which the forefeet are side by side. The latter arrangement is associated with power to climb a tree. The former means that the animal is purely terrestrial. These statements, however, are true only as generalizations. There are exceptions in all species. The ground squirrels conform to the rabbit type. The tracks are, of course, ideal, giving far more detail than is usually to be seen.

CHAPTER III

The Classification of Mammals: the Opossums, the Moles and Shrews, and the Bats

MAMMALS are classified by their most important anatomical and skeletal characters into a comparatively limited number of main groups termed "orders." Within each order are subordinate groups called "families," "genera," "species," and "subspecies," based on characters of lessening importance in the sequence of the groups named.

The species of each genus are more or less definitely separable, one from another. They possess differences in characters such as size, proportions, and colors. Species may have a very restricted or a very great range, at times of continental or even greater extent. The mountain lion, or cougar, is an extreme example of a wide-ranging species, as it occurs from coast to coast in North and South America, from southern Canada to Patagonia.

WHALES, BATS, AND MAN ARE CLASSIFIED TOGETHER

Most species of wide distribution are more or less plastic in response to differences of environmental influences, such as varied climatic conditions, altitudes, pressure of competition with related mammals of similar habits, and others. As a result, in different geographic areas within the range of a species its local representatives differ from their fellows in other areas in size, proportions, or colors, but are directly connected with the forms in adjacent areas by series of individuals in the intermediate territory which connect the forms by regular gradation. These locally modified forms representing a species are known as "geographic races" or "subspecies." Subspecies from widely separated areas may differ more from one another than do some species; yet the fact that they are not definitely segregated from each other, but are continuously connected by intergrading forms, requires that they be classed as subspecies. Some species of great range may include a considerable number of such geographic races.

The great division of the animal kingdom classified as mammals consists of warm-blooded vertebrates which are provided with mammary glands secreting milk with which the very young are nourished for varying periods after birth. In this fellowship Nature has combined such diverse organisms as whales, bats, and man.

THE MARSUPIAL MOTHER PUMPS MILK TO HER BABIES

The ancient Order of marsupials, or *Marsupialia,* differs from all other mammals in giving birth to the young in an imperfectly developed, or embryonic, condition. At birth they are transferred by the mother to the numerous teats located on the middle of the abdomen, usually inclosed in a pocketlike pouch, the marsupium. Here they remain until they complete their development and their naked bodies become clothed with hair. While the young remain attached to the long teats, the mother pumps milk directly into their stomachs by the contraction of special muscles controlling the mammary glands.

At present, marsupials occur only in North and South America and the Australian region. In the Americas they are represented only by opossums, but in Australia, Tasmania, New Guinea, and neighboring islands, they are the chief element in the mammal fauna. There, where the ordinary forms of mammal life are absent, they take on an extraordinary variety of forms, resembling various other orders of mammals, such as the wolflike thylacine of Tasmania, the rabbitlike bandicoots, the flying squirrellike phalangers, and others externally resembling mice, rats, tree squirrels, and moles. Still others assume forms strangely unlike anything known elsewhere in the world, such as the kangaroos.

From the southern United States to Patagonia occur a considerable number of genera and species of small marsupials typified by the well-known Virginia opossum, but varying greatly in size and general appearance. The smallest species occurs in southern South America and is about the size of a house mouse.

The large, coarsely haired opossums, largest of the Family *Didelphiidæ,* are characterized by the extent of the long, coarse hairs overlying their fur and by a curiously sluggish mentality. They are the only members of the family that feign death, or "play possum" when threatened with violence. Coarsely haired opossums include only a few species with a number of subspecies which range from the southern part of the Great Lakes far down into South America.

THE INSECT EATERS ARE FOUND IN MANY LANDS

The insect eaters of the Order *Insectivora* are all small mammals, varying from a tiny shrew, probably the smallest mammal in the world, weighing much less than an ounce, to others about two feet in length. They are of world-wide distribution, except in the Australian region, and vary greatly in their external appearance and mode of life. The lustrous, velvety fur of the shrews and moles contrasts strikingly with the bristling spines of the Old World hedgehog. The moles live in underground tunnels made by themselves; other insect eaters resemble miniature otters and have aquatic habits. Some are arboreal, like squirrels, and a few have developed a broad fold of skin along the sides of the body between the front and hind legs, and back along the sides of the tail, almost as in the bats, by means of which they glide from tree to tree like flying squirrels.

The moles (Family *Talpidæ*), with their velvety fur, piglike noses, and strong, paddlelike front feet, are the largest of the American insectivores and occur only in the temperate parts of North America, Europe, and Asia.

The Western moles (Genus *Scapanus*) are larger, more heavily furred animals than the better-known Eastern and European moles. They occur only on the Pacific coast from Washington to California.

The star-nosed mole (Genus *Condylura*) is much like the common moles of the Eastern and Western States, but is smaller and has a fringe of curious little wormlike, fleshy processes around the tip of the nose, which probably form sense organs helpful in locating prey in the earth through which the animal burrows.

SHREWS ARE FOUND FROM THE ARCTIC TO THE ANDES

The shrews, Family *Soricidæ,* are small, mouselike mammals with long, pointed noses and velvety fur. They usually frequent damp, sheltered places from the Arctic tundras south to the Andes of northern South America and the Himalayas in Asia. Members of this group have a close general similarity. They have been divided into several genera, a number of which occur in North America, but only two are treated here.

The long-tailed shrews (Genus *Sorex*) are circumpolar in distribution and are distinguished from the one described below by their slenderer bodies, proportionately longer, slenderer tails, and well-developed ears. A large number of species and subspecies are known in North America as well as in the Old World.

The short-tailed shrews (Genus *Blarina*) are darker-colored and more robustly built than the Genus *Sorex*. They have short, rather fleshy tails, and ears so short as to be practically hidden by the fur. This is an American genus with a number of species, ranging in eastern North America from southern Canada south to the southern United States.

BATS ARE THE ONLY MAMMALS THAT FLY LIKE BIRDS

Everyone is familiar with bats, which form the Order *Chiroptera.* These winged mammals are of world-wide distribution, except in the Polar regions. Members of this order are the only mammals having limbs modified for true, birdlike flight. Although species in several other groups have a membrane extending between the front and hind legs and sometimes along the tail, which enables them to glide from tree to tree, they are incapable of real flight.

Bats vary widely in form and size, ranging from the tiny butterflylike Pipistrelle, of the southwestern United States, less than an ounce in weight, to the great flying foxes of southeastern Asia, Polynesia, and the Australian region, the largest of which attains a wing-spread of about five feet.

Many kinds of bats are insect eaters, but perhaps an equal number feed upon fruits, especially in the Tropics where in parts of Australia the flying foxes are a pest to fruit growers. A few eat fish and the true vampires of tropical America have developed the aberrant habit of feeding exclusively upon the blood of living animals. Bats are nocturnal and usually live in caves, hollow trees, or other shelter, but some hang in open tree tops by day. The flying foxes sometimes hang in such numbers from the dead branches that the trees appear to be loaded with strange fruit.

The bats of North America, north of the Tropics, are nearly all insectivorous, but on rare occasions two fruit-eating species range north to southern Arizona. North American bats include many families, genera, and species.

A host of insect-eating bats of the northern temperate regions, of both the New and Old Worlds, belong to the Family *Vespertilionidæ,* but comparatively few of them penetrate the southern regions where so many other types of bats occur. None of them have the little nose-leaf that is so characteristic of many fruit-eating southern bats. The tail extends little, if any, beyond the flying membrane uniting the hind legs. Most of these bats are small and delicately proportioned, but some are more robustly built, like the species of *Nycteris.*

Little brown bats, Genus *Myotis,* are almost world-wide in distribution. In North America they are represented by many species and geographic races. In the United States some form of this genus is the commonest small bat in most localities.

The two species of red and hoary bats, Genus *Nycteris,* occur only in America, where they range widely.

The big-eared bats, Genus *Antrozous,* with great, upstanding ears and pale colors, are limited to the arid regions of the southwestern United States and similar regions in northern and northwestern Mexico.

The free-tailed bats, of the Family *Molossidæ,* are robustly built and have the ends of their tails projecting on top of, and free from, the membrane uniting the hind legs. Their ears are broadly rounded and flattened forward, so that they project like the visor of a cap over the eyes. They live in tropical and subtropical parts of the world, probably being most numerous in the Americas.

The musky roof bats, Genus *Tadarida,* of this family have thin, vertically flattened forms which enable them to creep into surprisingly narrow crevices in roofs of houses or in the rocky roofs of caves. They have a strong, offensive odor which makes their presence known wherever they occur.

VIRGINIA OPOSSUM: Didelphis virginiana and its subspecies

(*For illustration, see Color Plate, page* 33)

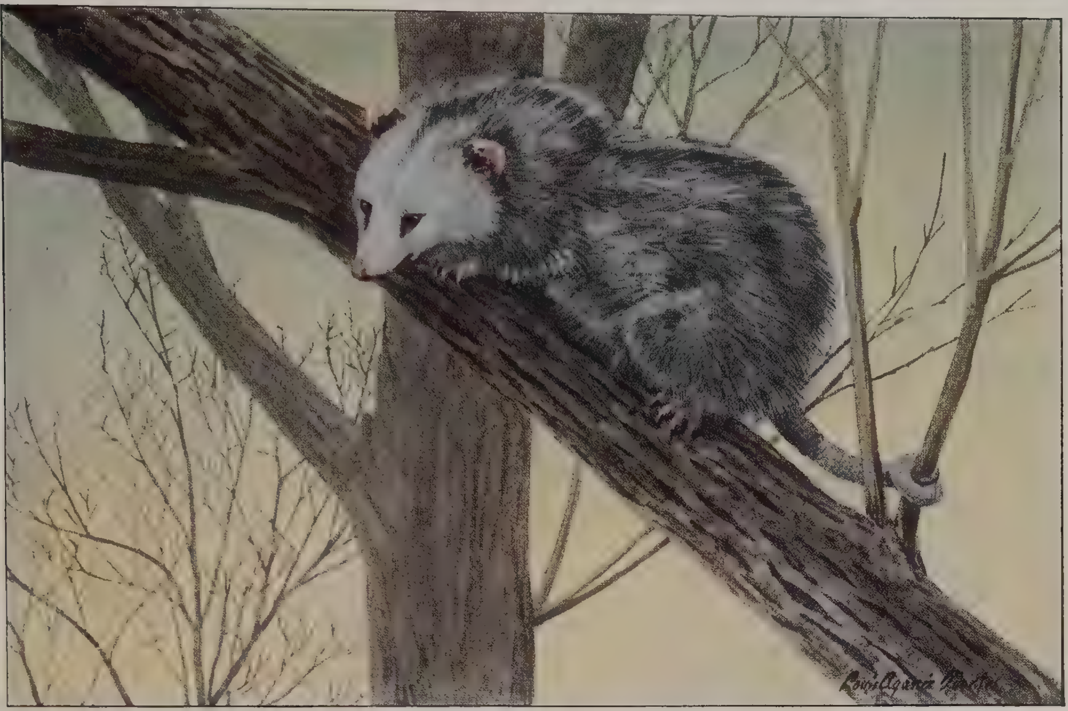
Numerous species of opossums are known, all peculiar to America and distributed from the eastern United States to Patagonia. The Virginia opossum, the largest of all the species, is characterized by its coarse hair, pig-like snout, naked ears, and long, hairless, prehensile tail. Its toes are long, slender, and so widely spread that its footprints on the muddy border of a stream or in a dusty trail show every toe distinctly, as in a bird track, and are unmistakably different from those of any other mammal.

Except in southern Texas, where a similar species takes its place, this is the only species of opossum occurring in the United States, where it occupies all the wooded eastern parts from eastern New York, southern Wisconsin, and eastern Nebraska south to the Gulf coast. Some years ago it was introduced into central California and now occurs in many parts of the southern half of the State. Although scarce in the northern parts of its range, it is abundant and well known in the warmer Southern States.

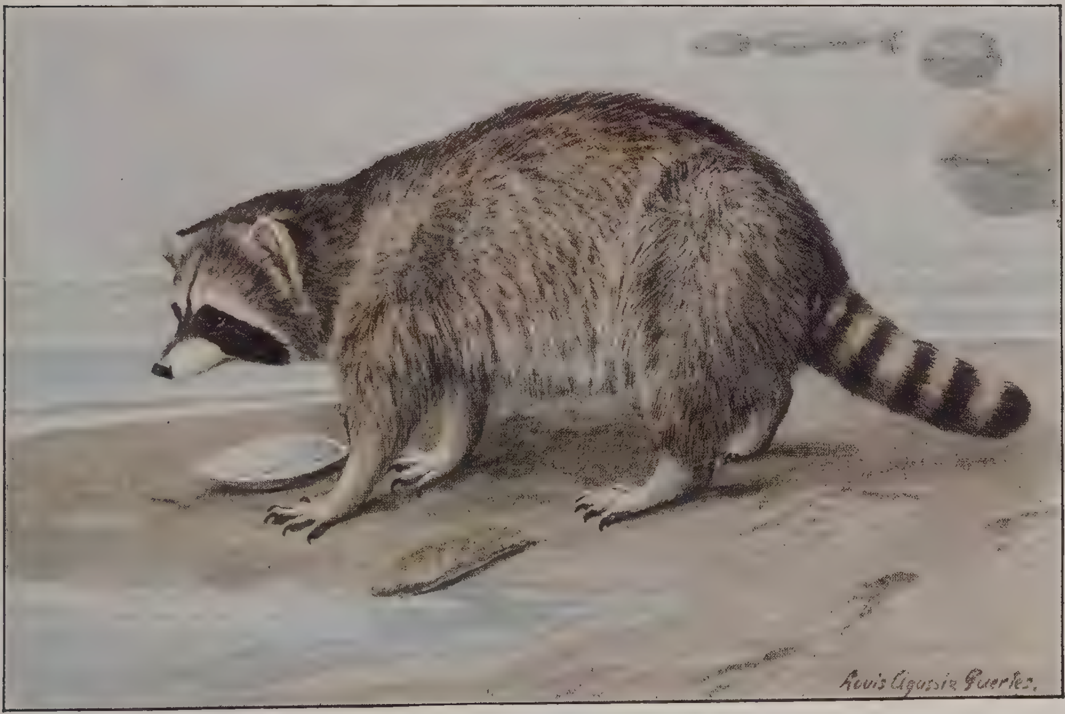
These animals love the vicinity of water, and are most numerous in and about swamps or other wet lowlands and along bottom lands bordering streams. They have their dens in hollow trees, in holes under the roots of trees, or in similar openings where they may hide away by day. Their food consists of almost everything, animal or vegetable, that is edible, including chickens, which they capture in nocturnal raids.

The Virginia opossums have from 5 to 14 young, which at first are formless, naked little objects, so firmly attached to the teats in the mother's pouch that they cannot be shaken loose. Later, when they attain a coating of hair, they are miniature replicas of the adults, but continue to occupy the pouch until the swarming family becomes too large for it. The free toes of opossums are used like hands for grasping, and the young cling firmly to the fur of their mother while being carried about in her wanderings.

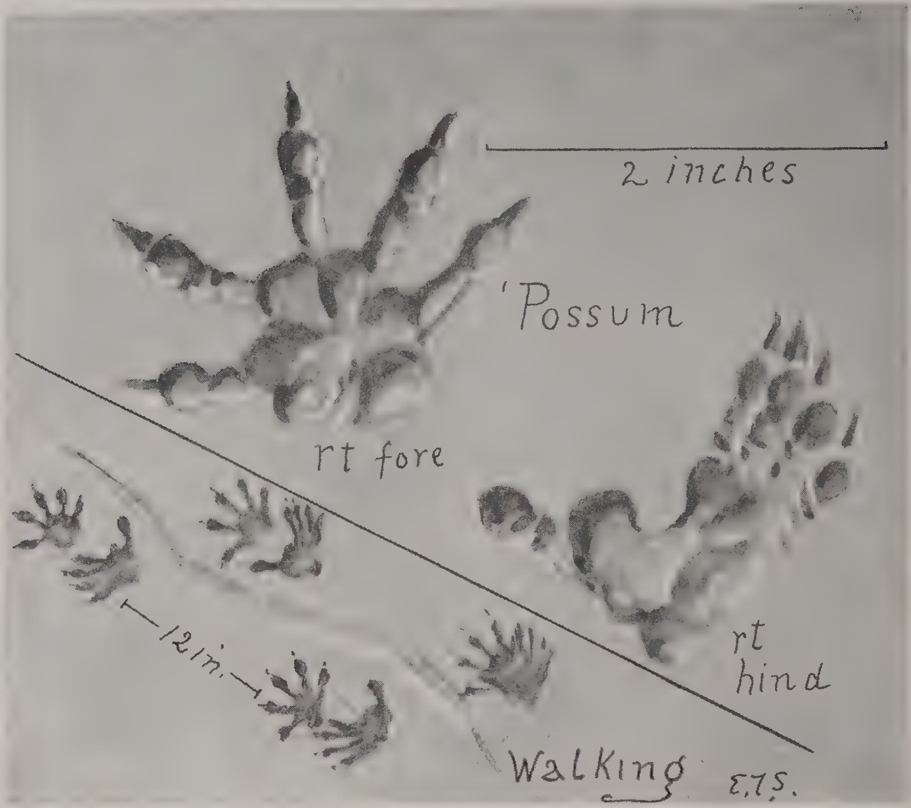
They are rather slow-moving, stupid animals, which seek safety by their retiring nocturnal habits and by nonresistance when overtaken by an enemy. This last trait gave origin to the familiar term "playing possum," and is illustrated by their habit of dropping limp and apparently lifeless when attacked. Despite this


Louis Agassiz Fuertes

VIRGINIA OPOSSUM
Didelphis virginiana


Louis Agassiz Fuertes.

RACCOON
Procyon lotor



UNMISTAKABLE HANDLIKE PAWS MARK THE TRACK OF THE OPOSSUM

The tail mark appears. The absence of claw on the thumb of the hind foot is usually seen.

apparent lack of stamina, their vitality is extraordinary, rendering them difficult to kill.

While hunting at daybreak, I once encountered an unusually large old male opossum on his way home from a night in the forest. When we met, he immediately stopped and stood with hanging head and tail and half-closed eyes. I walked up and, after watching him for several minutes without seeing the slightest movement, put my foot against his side and gave a slight push. He promptly fell flat and lay limp and apparently dead. I then raised him and tried to put him on his feet again, but his legs would no longer support him, and I failed in other tests to obtain the slightest sign of life.

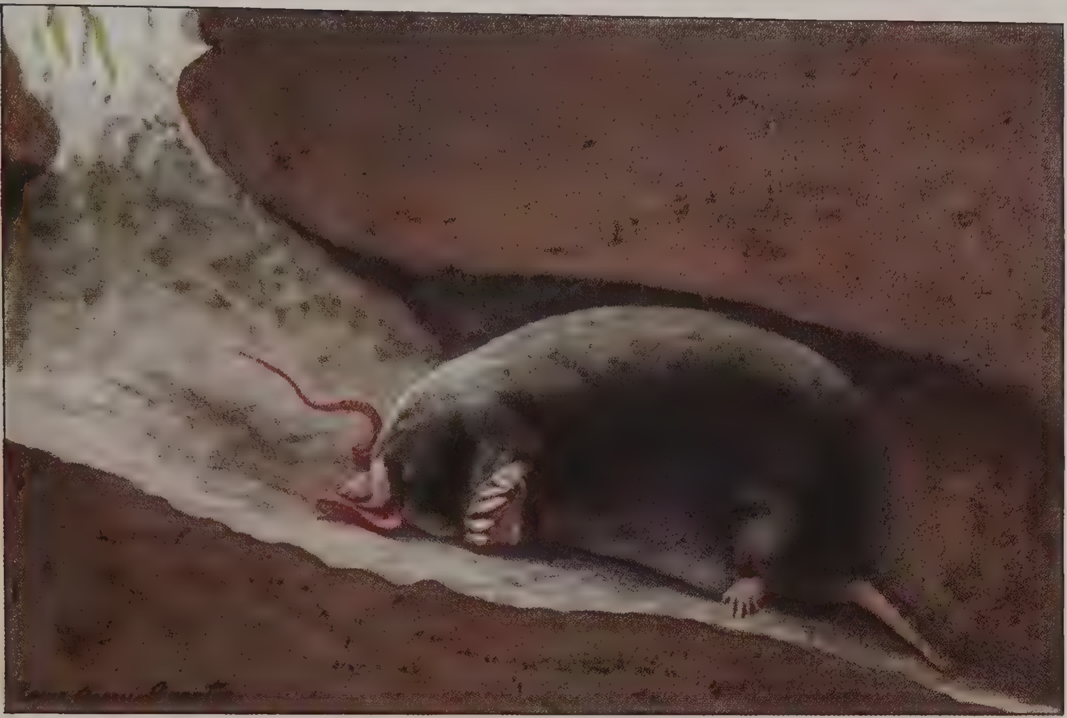
The opossum has always been a favorite game animal in the Southern States, and figures largely in the songs and folklore of the southern negroes. In addition, its remarkable peculiarities have excited so much popular interest that it has become one of the most widely known of American animals.

OREGON MOLE: Scapanus townsendii
and its relatives

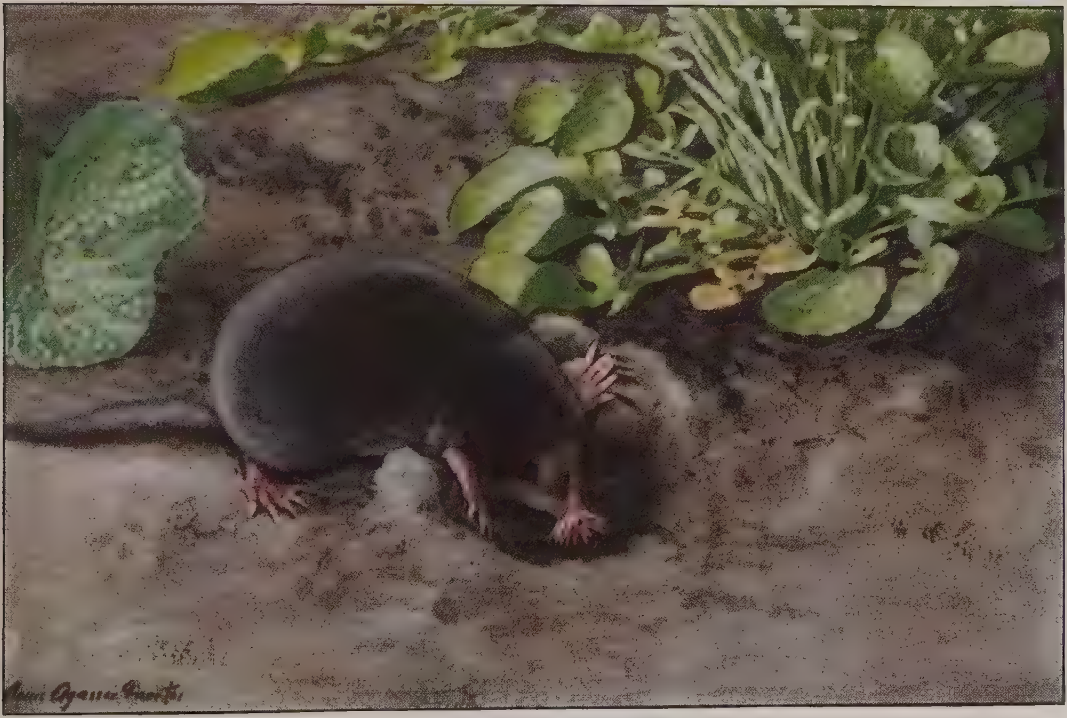
(*For illustration, see Color Plate, page* 35)

The effect on mammals of a narrowly specialized mode of life is well illustrated in the mole. It is an expertly constructed living mechanism for tunneling through the earth. The pointed nose, short neck, compactly and powerfully built cylindrical body, with ribs strongly braced to withstand pressure, and the short, paddlelike hands armed with strong claws for digging, are all fitted for a single purpose. Eyes and ears are of little service in an underground life, so they have become practically obsolete; the fur has been modified to a compact velvety coat which will lie either front or back with equal facility and thus relieve any friction from the walls of the tunneled roads, no matter which way the animal travels.

Moles are circumpolar in distribution, being found from England to Japan in the Old World and on both the Atlantic and Pacific coasts of the New World, where they occur only in North America. On this continent they are limited mainly to the United States and southern Canada, extending across the Mexican border only in two limited areas at the extreme east and west. Their distribution is not continuous across the continent, but is broken by a broad, unoccupied belt formed by the arid interior, including the Great Basin. The home of the Oregon mole lies in the humid area west of the Cascade Mountains in Washington, Oregon, and extreme northwestern California. Closely related species range from eastern Oregon southward through California to the San Pedro



OREGON MOLE
Scapanus townsendii



STAR-NOSED MOLE
Condylura cristata

Martir Mountains in Lower California, and others north into British Columbia.

The Oregon mole is the largest and handsomest member of the group in America and perhaps in the world. Its skin, a velvety coat of nearly black fur, often with a purplish sheen, now brings a higher price in the market than that of any other species. Its size and the beauty of its dark coat distinguish it from any other mole.

Where the soil is loose the mole practically swims through it, urged forward by powerful impulses of its "hands" and feet. This is the common mode of travel near the top of the ground; where the course is marked by the lightly upheaved and broken ridge on the surface. When working at a greater depth and in more compact soil, the mole must dig its way and dispose of the loose earth by pushing it along the tunnel to an outlet at the surface through which it is thrust to form a mound similar to the "dumps" of those other great miners, the pocket gophers.

On account of this similarity in mode of life, moles and pocket gophers are sometimes confused by persons not familiar with the two animals. The resemblance ends in this apparent likeness, for the pocket gophers belong to the great Order of *Rodentia,* or gnawing animals, while the moles are of the *Insectivora,* or insect eaters.

The superbly forested region inhabited by Oregon moles is so well watered that few places, even on high mountain slopes, are too dry for them to occupy. These animals are generally distributed, and their hills may be seen in the midst of the great coniferous forests as well as in the open valleys.

They are most abundant in open, grassy areas, especially in meadows and in the bottoms of canyons and similar places, where the damp, rich soil affords a plentiful supply of earthworms, grubs, and insects on which to feed. Like other moles, they lead lives of great activity and almost constant hard labor. During damp weather they work near the surface, but in dry periods, as the upper soil hardens, they follow their prey to lower levels. A hard shower, however, always brings an outburst of activity, as they reoccupy the upper soil and throw up a multitude of new mounds. They have the habit of regularly coming to the surface to hunt food during the night. This is no doubt coincident with the swarming up to the surface of earthworms on which the moles feed. At such times many are captured by owls, cats, and other beasts of prey.

The runways of moles close along the surface, shown by well-marked ridges, are for hunting purposes, and the lower tunnels, from which the earth in the mounds is brought, are for traveling and lead to the nest chamber. The deep tunnels of the Oregon mole sometimes extend considerable distances along fences, or other surface cover, which afford more or less protection.

The Oregon mole's tunnels often make a many-branched, intricate system, crossing here and there and covering a considerable area. The courses of the main tunnels are usually marked by a series of loose earth mounds from 4 to 10 inches high and from 5 to about 20 inches wide at the base. These may be scattered over meadows or other fields at distances of from two to six feet. The tunnels become convenient highways for the moles, but are used also by shrews and field mice. The extent of their use by moles is indicated by the fact that sometimes more than 20 of them have been taken in one.

Owing to the persistence with which the moles raise their mounds everywhere in the occupied parts of their territory, they have become a serious and costly pest. In meadows the knives of mowing machines are dulled by them, and in towns lawns are disfigured by their undesirable activities. As a consequence, they have now fallen under the ban and are classed with other mammals which have shown their lack of ability to fit in satisfactorily with the changed conditions brought to their ancient territory by civilized man. Under natural conditions their activities were undoubtedly entirely beneficial.

They appear to have but a single litter of young, numbering from one to four, each year. These are born in March and grow so rapidly that by the last of May they are working in the tunnels and are scarcely distinguishable from the adults.

The recent discovery that the Oregon moleskin is valuable for its fur will give such an incentive to trapping that there is little doubt the boys of the State within a few years will reduce the numbers of the animal and thus control its injury to agriculture. The market for the skins appears practically unlimited, judging by trade reports, one dealer in Brooklyn stating that in a recent year he dressed 4,000,000 imported European moleskins.

STAR-NOSED MOLE: Condylura cristata

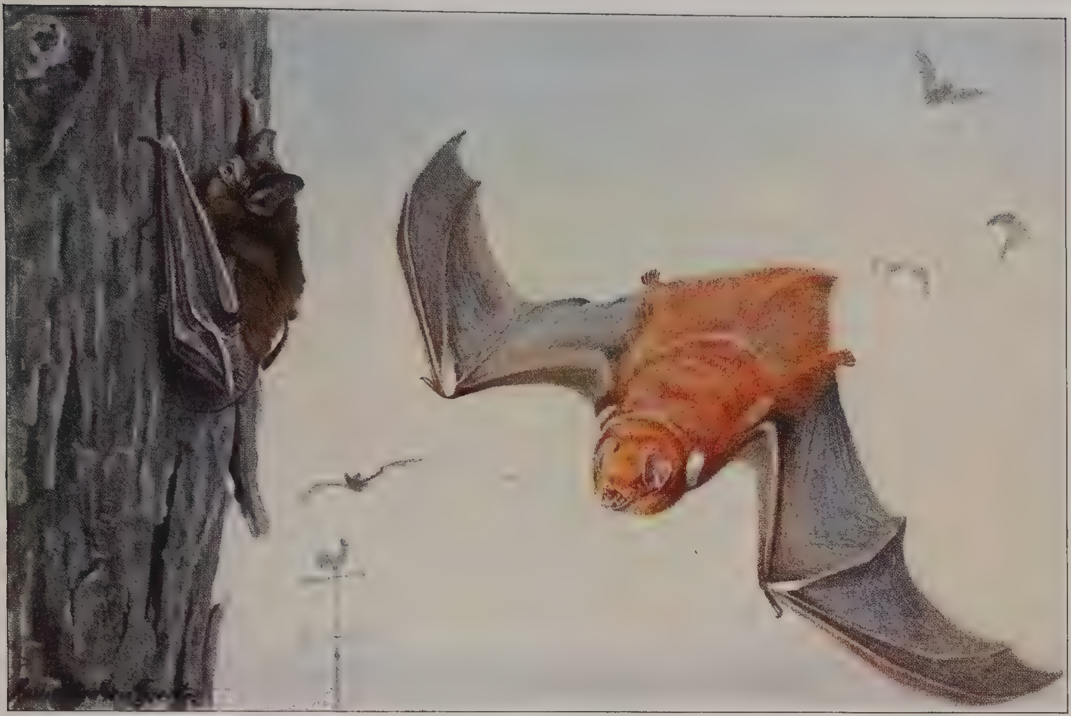
(*For illustration, see Color Plate, page* 35)

The star-nosed mole, known in parts of Maine as the "gopher," is peculiar among the moles in having a fringe around the end of its nose formed by twenty-two short, fleshy tentacles. A less-marked character is in the proportionately long tail, which becomes greatly enlarged in fall and remains in this condition during the winter months. Otherwise, the external appearance of this species is much like that of the common moles of America and the Old World.

The star-nosed mole is found from southern Labrador. the southern end of Hudson Bay, and southeastern Manitoba south along the Atlantic coast to Georgia and in the interior down the Alleghenies to North Carolina and to Ohio, Indiana, Illinois, Wisconsin, and Minnesota. Throughout this area it ranges irregularly and much yet remains to be learned about the details of its distribution and habits.

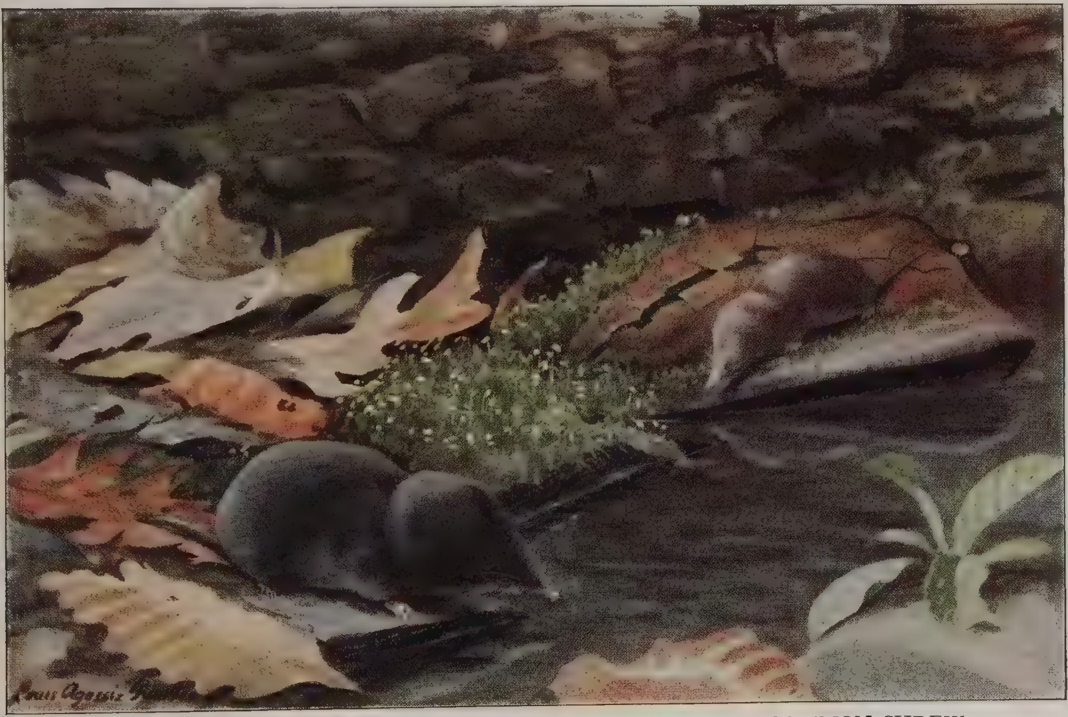
Ordinarily solitary, these moles at times are so numerous in limited areas that they appear to form colonies. Such gatherings probably mean an unusually rich feeding ground, which makes it unnecessary for the young to disperse to outlying locations, as is the habit of moles and most other mammals.

The star-nosed mole has a strong preference for damp and even marshy or swampy locations.



COMMON LITTLE BROWN BAT
Myotis lucifugus

RED BAT
Nycteris borealis



SHORT-TAILED SHREW
Blarina brevicauda

COMMON SHREW
Sorex personatus

It frequents low-lying meadows, the borders of streams, and grassy swamps, where its underground burrows alternate with open surface runways among grass roots and other matted vegetation. It spends far more time above ground than the other moles, and not infrequently swims among flooded cat-tails and other vegetation. In winter, it has been seen swimming under the ice.

Like others of its kind, this mole is amazingly powerful in proportion to its size. It persistently adds to its surface ridges, and, in constantly extending its deeper tunnels, must dig loose earth and dispose of it by forcing it up through an outlet to form the mounds which mark the course of its travels. Where the soil is loose it readily forces it aside with its compact body and paddle-shaped hands. In pushing up the little piles of earth and in the ridges raised when burrowing close to the surface, it sometimes injures meadows and other cultivated land. Occasionally it wanders away from the fields and invades lawns and gardens, where the only injury it does is in the disturbance of the soil.

Its nests are compact little balls of fine grass, weeds, or leaves in dry underground chambers excavated in its burrows. The nests are a foot or two underground, but above the level of the water, sometimes under a stump and again in a knoll or bank. One nest containing five young was found in Maryland in an old woodshed under several inches of chips. This location and its choice of a site for its nest under a stump in a field or in a dry knoll are clear indications of a kind of intelligence which even the lowliest animals appear to have in caring for their young.

The star-nosed mole is full of the restless energy so necessary in a mammal which must come across its food by more or less haphazard tunneling through the soil. It is active both summer and winter. In dry weather, as the moisture near the surface decreases, the soil hardens and earthworms and other subterranean life seek deeper levels. The mole follows them, only to return with them nearer the surface with a renewal of the moisture. In winter it sometimes comes out and travels slowly about on top of the snow, ready to burrow out of sight at once, however, at the sound of approaching footsteps.

The food of the star-nose, like that of most other moles, is made up mainly of earthworms, white grubs, cutworms, wireworms, and other underground insects. In captivity, before eating a worm or other flesh food offered, it first feels of it with the little raylike organs of touch on its nose. It is difficult to surmise the real value of these "feelers," for it would seem that the acute sense of smell so common to mammals should do better service.

Aside from its disturbance of the surface soil by its ridges and mounds, the star-nosed mole does no direct injury, and its life is largely passed in the useful task of searching out and destroying insects. Indirectly, it causes some injury to root crops, plants of various kinds, and fruit trees, by providing tunnels along which meadow and pine mice travel to commit the ravages which on circumstantial evidence are charged to the mole.

COMMON SHREW: Sorex personatus
and its relatives

(For illustration, see Color Plate, page 37)

Many interesting small mammals are nocturnal or lead such obscure and hidden lives that they are rarely observed except by naturalists. Of these are the numerous species of shrews, which include the smallest mammals in the world. These tiny beasts all live among the vegetation and débris on the surface of the ground or in little burrows below. With the moles they are members of the Order *Insectivora* and depend mainly on insects and meat for food. Despite their minute size, they are possessed of indomitable courage and ferocity, which lead them without hesitation to attack and kill mice many times their own weight.

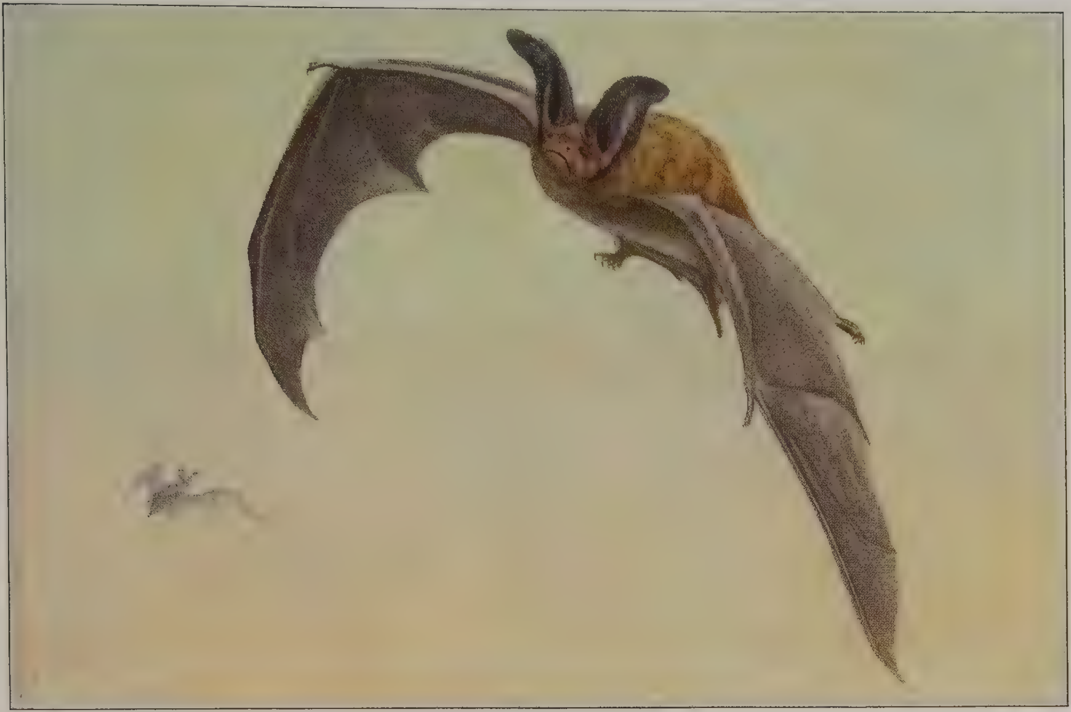
The Genus *Sorex,* of which the common shrew is a member, is circumpolar in distribution, the various species ranging through England, the European mainland, Asia, and North America as far south as Guatemala.

The common shrew is a purely North American animal, occupying all the northern part of the continent from the Arctic shores of Alaska and Canada, south to northern Nevada, South Dakota, Illinois, and Pennsylvania, and along the Allegheny and high Rocky Mountains to North Carolina and New Mexico. Its vertical range extends from the seacoast up to timberline in the Rocky Mountains.

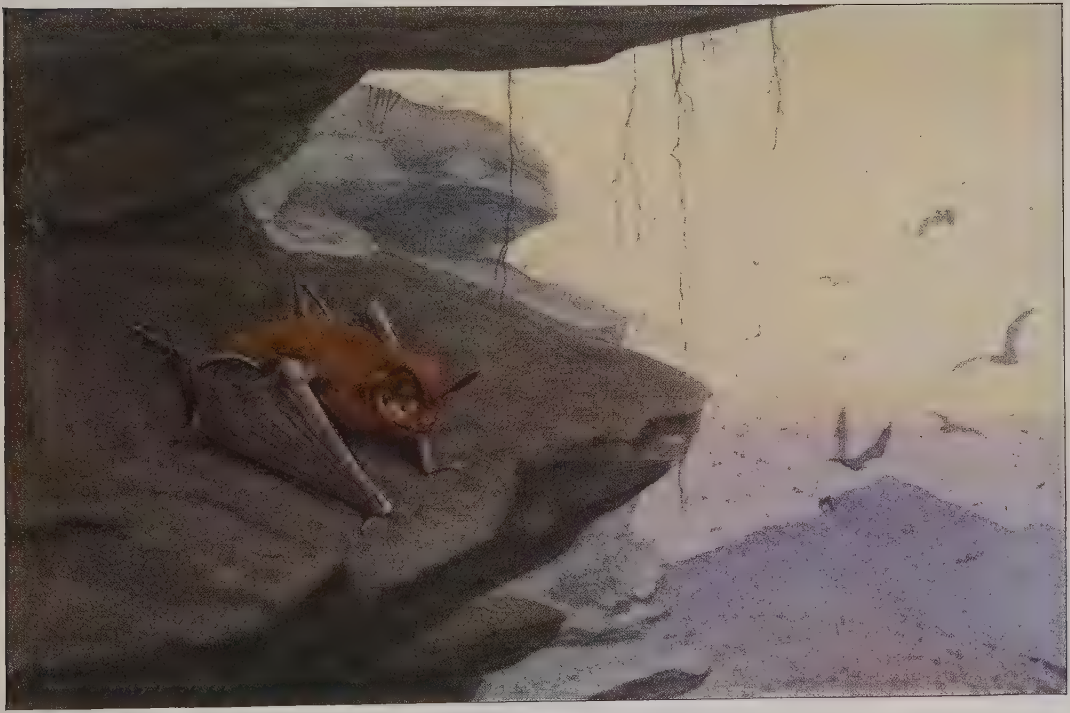
The common shrew is the smallest of the mammals in all the northern parts of this continent, and one marvels at the possibility of such a tiny morsel of flesh and blood withstanding the rigors of the Arctic winters. It measures about 4 inches in total length and weighs about 45 grains; the body and tail are slender, the nose long and sharp, and the rim of the ears shows a little above the dense, velvety fur. By these characters it may be distinguished from the larger, more heavily proportioned (and darker-colored) short-tailed shrews which abound with it in certain parts of its range. Its smaller size and grayish-brown color are the main superficial differences between it and other American members of the same genus. The climatic differences in its wide range have developed several geographic races, none of which, however, show strongly marked characters.

This shrew appears to have a most catholic taste, so far as its surroundings are concerned, for it appears to frequent every type of situation where shelter and food can be found. It abounds among the peat beds and sphagnum mosses of the desolate Barrens bordering on the Arctic coast, as well as amid the rotten stumps, old logs, fallen leaves, and other vegetable débris on the floor of the forests farther south. It will be found also in the rank, matted vegetation about marshes, in old fields and occasional sphagnum swamps in the southern parts of its range.

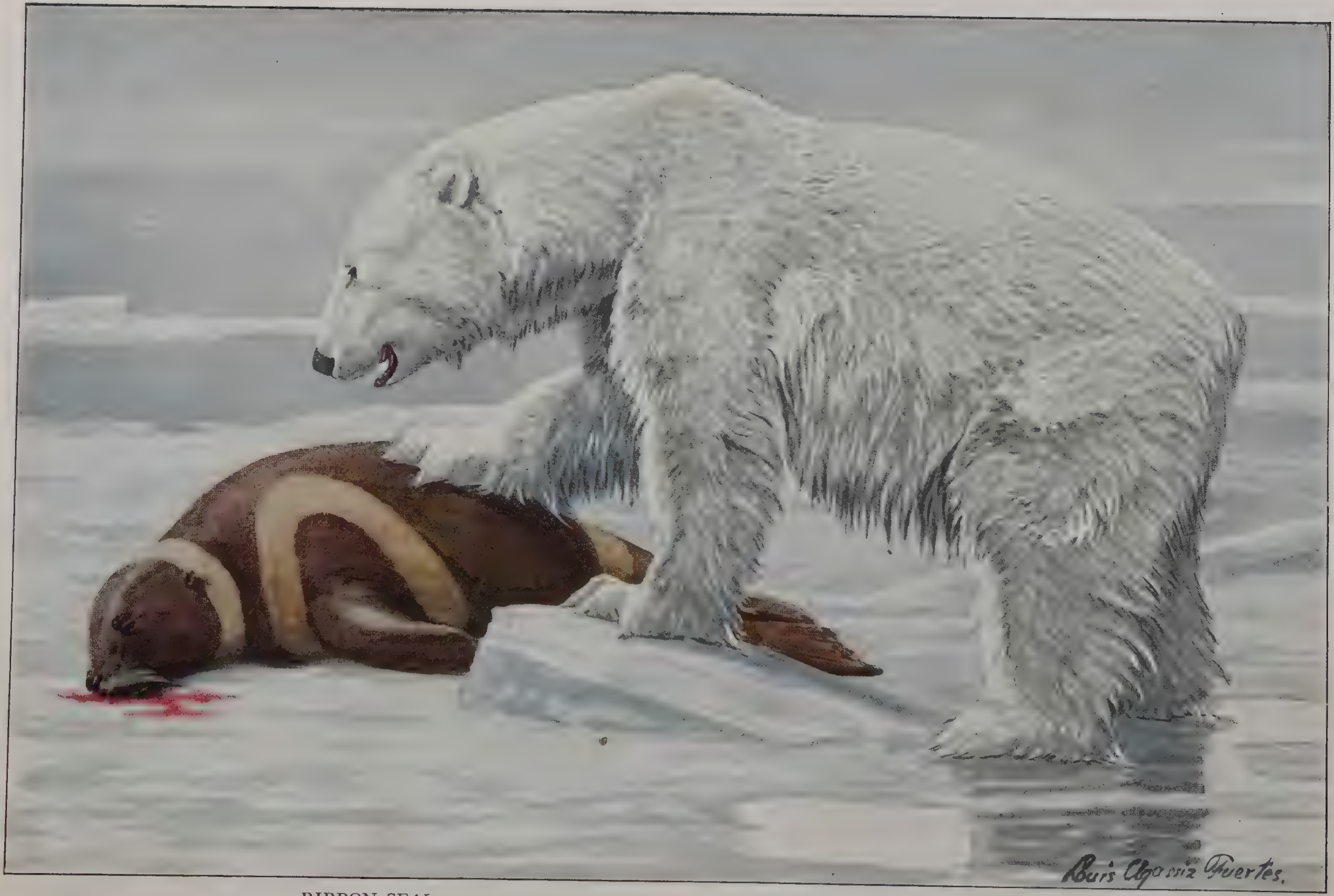
The little tunneled runways of these shrews form a network in the beds of moss of a sphagnum swamp near Washington, D. C. In the forest the animals always seek the cover afforded by fallen logs, slabs of bark, or anything else that will give protection. On the coast of New Jersey they live so near the sea that an extra



BIG-EARED DESERT BAT
Antrozous pallidus

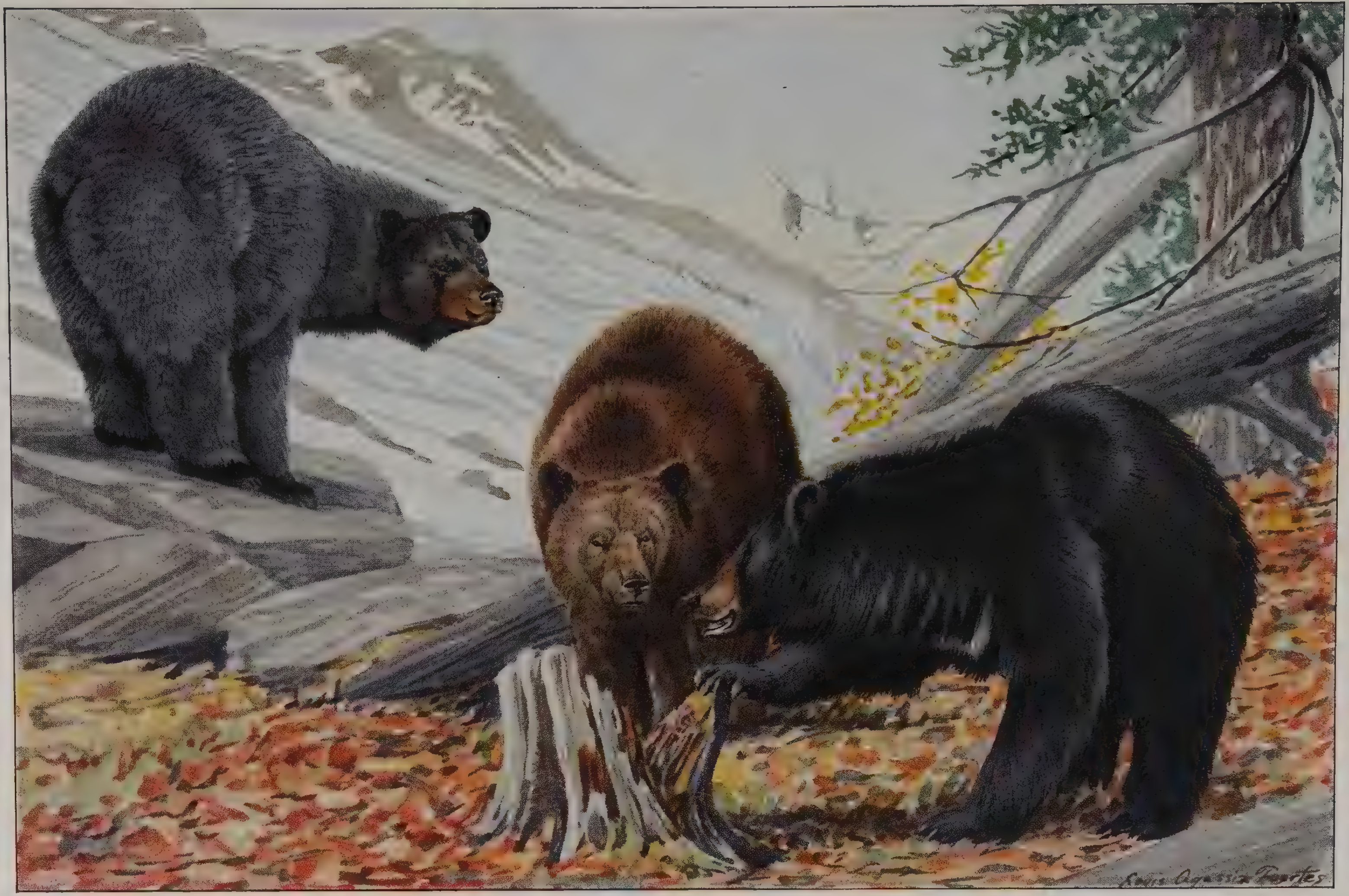


FREE-TAILED MEXICAN BAT
Tadarida mexicana



RIBBON SEAL
Phoca fasciata

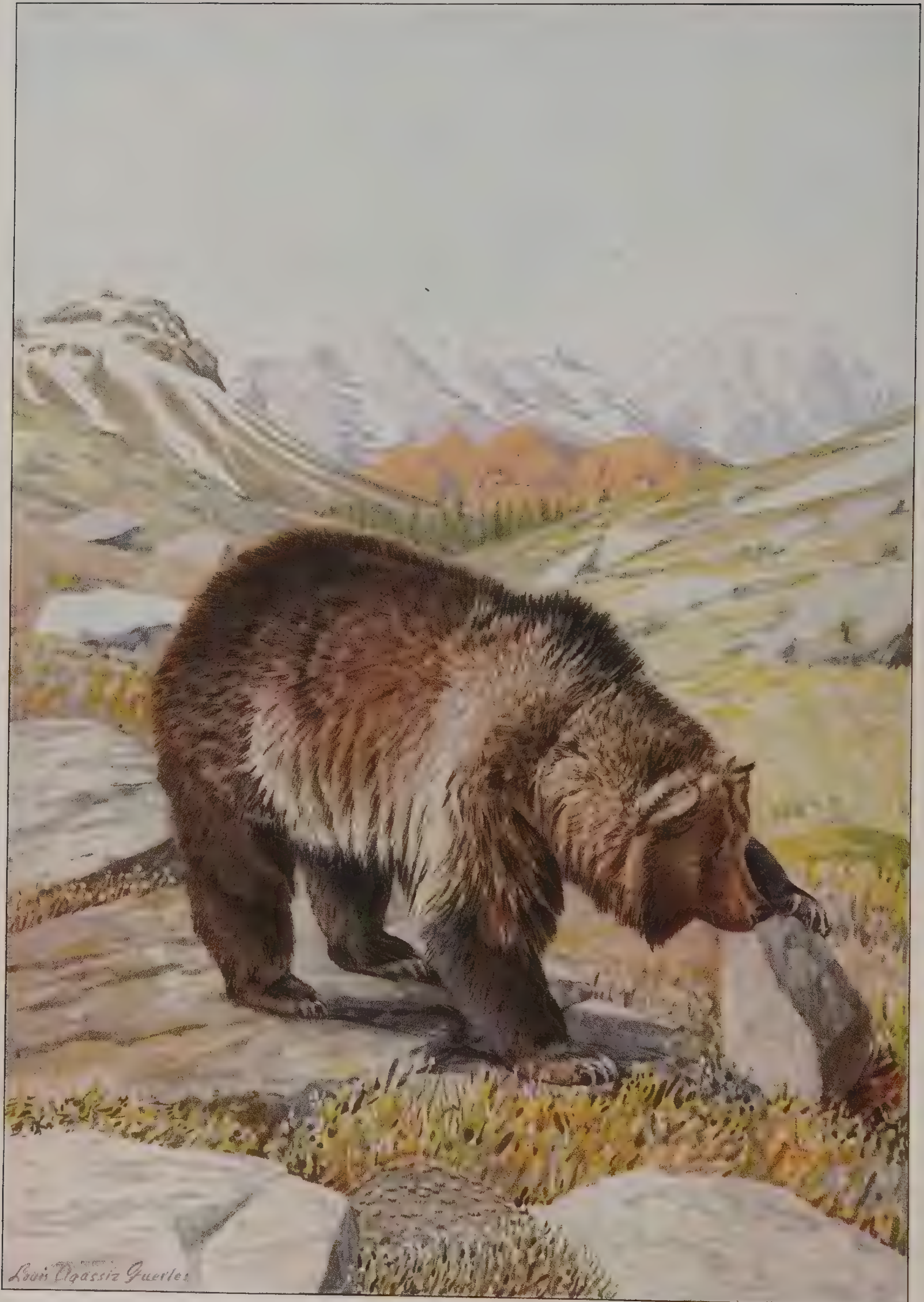
POLAR BEAR
Thalarctos maritimus


Louis Agassiz Fuertes

GLACIER BEAR
Euarctos emmonsii

CINNAMON BEAR
The cinnamon bear is merely a color phase of the black bear

BLACK BEAR
Euarctos americanus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GRIZZLY BEAR
Ursus horribilis

high tide forces them to mount the drift logs on the salt meadows for safety. They often make little burrows in the soft earth under the roots of a tree, a stump, or a log.

Their nests are small balls of dry leaves, grasses, or other soft vegetable material placed snugly under a log or in a hollow stump, burrow, or other good retreat, where they appear to have two or more litters or from 6 to 10 young during the summer and fall.

As in the other shrews, the food of the common species consists mainly of insects, larvæ, worms, and obtainable flesh; but in winter and possibly at other seasons many kinds of food are eaten, including insects, meat, fat, flour, and seeds. During the years I passed at St. Michael, on the coast of Bering Sea, the beginning of winter always brought into the storehouses and dwellings a swarm of field mice, lemmings, and these shrews. The food requirements of all appeared to be the same, and all fed freely on the flour and other accessible stores. Dozens of the shrews were killed in the houses every winter.

Occasionally I caught and kept one captive for a time to observe its habits. It would be extremely restless and equally active by day or night. The small eyes appeared of little service, but the long, flexible snout was used constantly and served as the main reliance of the little beast for information as to the outside world.

Wherever they travel, these shrews utilize the runways of the field mice or other small animals and make little runs of their own only where necessary. Aside from a faint squeak, I have never heard them utter a sound, but other observers credit them with series of fine twittering notes apparently uttered as a song.

The common shrew is a solitary animal of so morose a disposition that if two are placed in a cage together, they almost immediately fall upon one another with tooth and nail, and the victor devours the body of its companion at a single meal. The digestion of shrews is so rapid and the call for food so incessant that it requires constant activity to keep the demand satisfied.

After the winter snow arrived in Alaska, I found many tunnels of these shrews running just under its surface and raising it a little in a slight but distinctly rounded ridge. Such tunnels wandered widely. On the ice of the Yukon River I traced one of them more than a mile and repeatedly saw them crossing the river from bank to bank. It was surprising to note the ability of the little travelers under the surface to keep in so nearly a direct line for long distances.

At times these little adventurers make similar tunnels in the snow far out on the sea ice. The mythology of the Eskimos contains accounts of many supernatural animals which a lone hunter may meet and which have the power to do him deadly harm. Among these the "sea shrew" is one of the most malignant. Its appearance is described as exactly like that of the common land shrew, but it is said to live on the ice at sea and, if it sees a hunter, it darts at him through the air, pierces the skin, and, after running all through the body with incredible rapidity, enters the man's heart and kills him. As a result of this belief, the Eskimo hunters were in mortal terror if they chanced to encounter a stray shrew on the sea ice. I knew one hunter who, suddenly meeting one on the ice, stood motionless for hours until the shrew wandered out of sight. He then hastened home and all the other hunters agreed that he had had a lucky escape.

SHORT-TAILED SHREW: **Blarina brevicauda** and its relatives

(For illustration, see Color Plate, page 37)

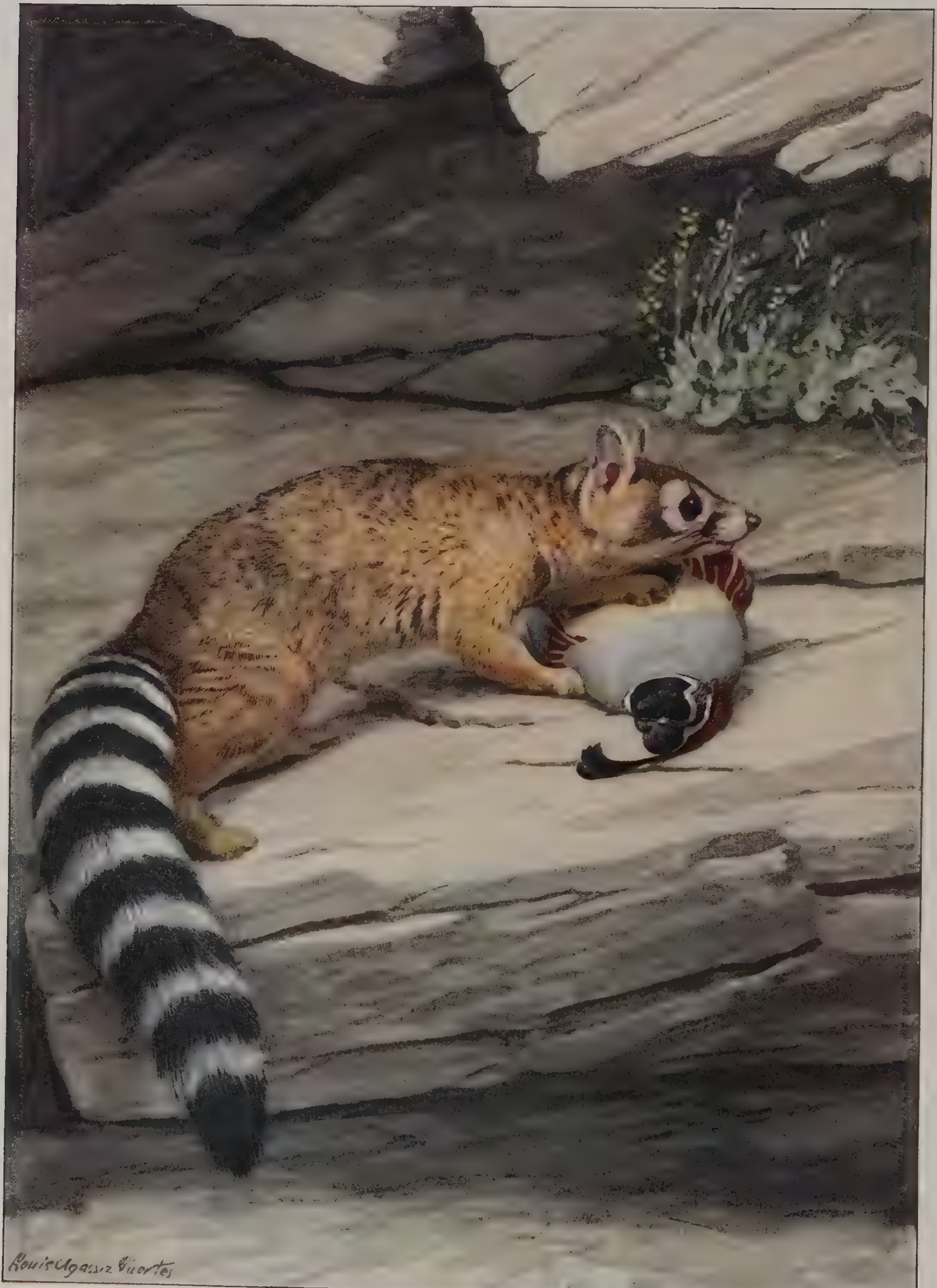
Of the several groups of genera and species of the mouselike animals known as shrews and peculiar to North America, one of the most numerous and best known is the short-tailed shrew. It is a dark-colored animal much more heavily proportioned, larger, and with a shorter tail than the common shrew. Its fur is so thick and velvety that it is confused by many people with the mole, despite its smaller size.

The short-tailed shrews, sometimes called "mole shrews," of the Genus *Blarina* belong to a single species with several geographic races. They occupy eastern Canada and the United States, from Nova Scotia, southern Quebec, Ontario, Minnesota, and North Dakota southward to Florida and the Gulf coast as far as eastern Texas. Vertically, they range from sea level up to the tops of the Alleghenies. Another group of American shrews, containing numerous species belonging to the Genus *Cryptotis,* occupies the mountains of the Western States, and ranges south to northern South America. In external form it is indistinguishable from the short-tailed species.

Probably no mammal is more numerous in the eastern United States than the short-tailed shrew. It occurs everywhere—in forests, in brushy areas, in old fields, and along grassy banks. In Washington, D. C., it is common in Rock Creek Park, where it lives in covered runs which it makes among the grass and fallen leaves. These shrews drink frequently, and this may in part account for their abundance near streams or other water, although it may be the desirable moist soil conditions which draw them to such situations.

The runways of these shrews are scarcely half an inch wide, usually partly sunken in the mold or rotting surface vegetation. They are not made by digging, but by pushing aside the loose mold, and they cross and recross in an irregular network. They lead to the entrances to burrows which generally drop nearly straight down. The burrows are sometimes amid the leaves, but usually under the shelter of a root, stump, old log, or other cover. In addition to their own runways, the shrews make free use of those of meadow mice and even traverse the tunnels of the pine mice and moles in their restless search for prey.

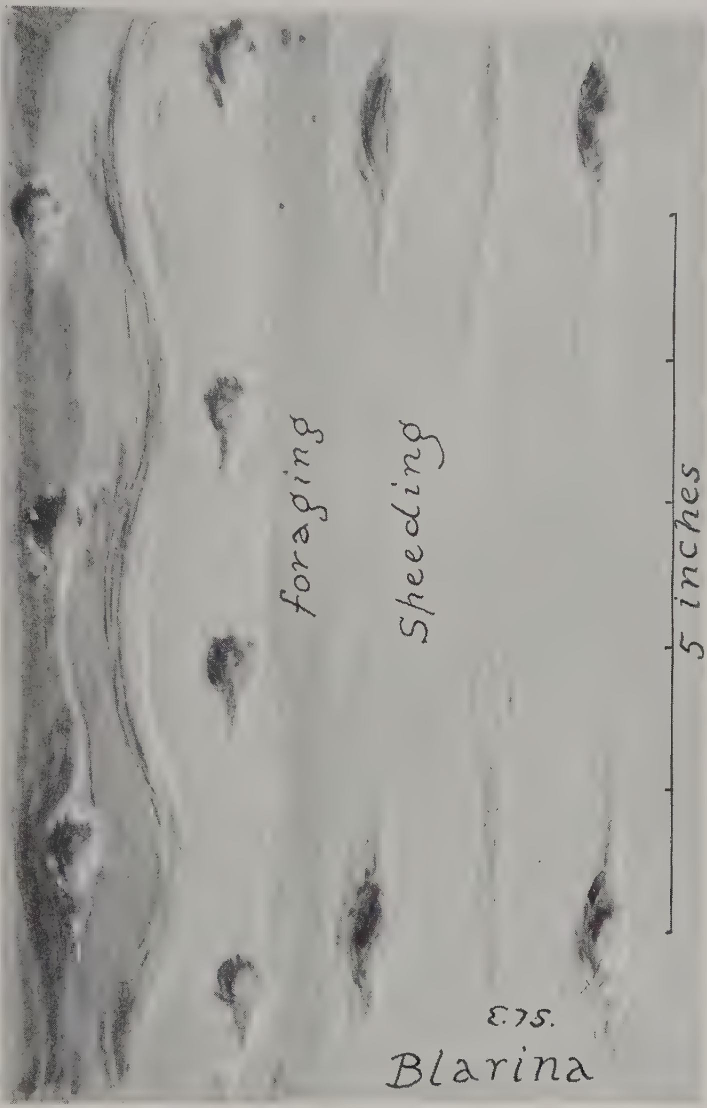
Small rounded chambers opening off their underground runways are filled with fine grass, pieces of leaves, and other soft matter for a nest. One nest examined was made entirely from the hair of meadow mice, probably the spoils of war from the bodies of victims. As a rule, shrews are extremely unsocial, but a pair of this species is sometimes found occupying the same nest, no doubt a temporary arrangement. Several litters, containing from four to six each,


Louis Agassiz Fuertes

RING-TAILED CAT
Bassariscus astutus

appear to be born through the summer and fall, usually beginning in June.

While equally active by day and by night, the eyes of these shrews seem to be of little use except to distinguish between light and dark. But their senses of hearing and smell are highly developed, as is also the sense of touch in their long hairs, or "whiskers," about the nose. In captivity an extreme sensitiveness is exhibited to sudden sounds, especially such as those of a bird's wings, indicating an instinctive fear born of age-long persecution by birds of prey. Food is located by smell, and as the flexible end of the snout is moved continually from side to side, odors are caught which may register conceptions as definite in the minds of these small animals as sight does in more favored beasts. All shrews are provided with musk glands and therefore are apparently nauseous to most other animals, as they are rarely eaten by beasts of prey. These musky secretions must be of great service in aiding them to locate one another.



THE SHORT-TAILED SHREW, OR BLARINA, MAKES A CURIOUS GROOVED TRACK IN THE SNOW

The tail mark is seen on the left.

Like other shrews and the moles, their digestion appears to be very rapid and they will eat two or three times their own weight in a day. This necessitates great activity on their part during much of the time in order to find the required food. They prefer insects and meat, but are practically omnivorous, feeding not only upon many kinds of insects, but on earthworms, slowworms, sow bugs, snails, slugs, mice, shrews, and the young of ground-nesting birds, as well as such vegetable food as beechnuts, seeds, bread, and oatmeal.

The instinct of prevision against the season of winter scarcity appears to be developed in them, as one in captivity buried beechnuts in the earth. They are also known to store living snails in small piles and to gather disabled beetles in storerooms in their tunnels.

The courage and blind ferocity of the short-tailed shrews when they are placed near captive mice far larger than themselves are amazing to all who witness their encounters. They attack instantly, spreading their front feet to gain a firmer footing and moving forward in little rushes. Mice larger and much more powerful than the shrew are persistently attacked and, finally giving out, are pounced upon and the flesh torn from their heads and necks with ravening eagerness. One day a passing observer heard a loud squealing on a railroad bank. An examination revealed a short-tailed shrew dragging away a nearly dead pine mouse, though the mouse was much the heavier.

The notes of shrews are a fine, tremulous squeak, which becomes a longer, harsher, and more twittering or chattering cry when they are angry.

No cessation of their activity occurs in winter. When the cold weather begins, many gather about barns and houses located near woods or old fields, and thus with the field mice take advantage of the garnered food supplies and shelter. Others remain in their regular haunts, where they frequently burrow long distances in the snow, making networks of tunnels and traveling long distances just below the surface, raising on the ground little ridges like those of moles. Their journeys upon and under the surface of the snow appear to be in search of food, as they burrow down to old logs and stumps which make good feeding grounds. Their movements are very active, as they go about either at a walk or quick trot.

These fierce and truculent little hunters are wholly beneficial in their habits and should be encouraged instead of being killed on sight indiscriminately, like one of the ordinary mouse tribe.

COMMON LITTLE BROWN BAT: Myotis lucifugus and its subspecies

(*For illustration, see Color Plate, page* 37)

This slenderly built, tawny-brown little bat is the most hardy and widely distributed of its kind in North America. It ranges from sea level up to 11,000 feet altitude and from coast to coast in the northern United States, extending thence north to about tree limit on the borders of the arctic tundras in Labrador, Canada, and Alaska. To the southward it goes down eastern Mexico to the State of Chiapas.

It is the most abundant species of bat in all the eastern half of the United States. In this region nearly everyone, whether he live in town or country, has seen many of these little winged beasts. They come out of their hidden daytime retreats on the approach of dusk and go careening up and down streets, about buildings, along roadways, or over water in pursuit of the many kinds of night-flying insects they feed upon. By day they ensconce themselves in attics or other dark and sheltered places in buildings, or in caves and crevices in cliffs, where their presence is often betrayed by little grating squeaks. They often share their retreats in friendly association with other kinds of small bats.

When they first come out in the evening, many of them may be seen flying low over water, slaking their thirst by dropping down in little descending curves and daintily scooping up mouthfuls, each time causing tiny ripples as they break the surface.

As in the case of numerous other insect-eating bats, their flight when hunting is a marvelous exhibition of aërial gymnastics that no feathered creature could equal. Their apparently erratic zig-zags, loops, turns, and twists appear meaningless unless one understands that at the end of each of these little irregularities of course, the flyer has probably captured one of the insects on which it preys. One may verify this, as I have done, if he has opportunity to watch these bats work at close range against the lighted background of the afterglow.

Little brown bats have a single young, usually born about the middle of June in the northern United States. Just when their mating season occurs, and what their period of gestation is, are among the many things we do not know about their life histories. One pair has been observed mating in August.

Many bats, including this subject, have the habit of hibernating during cold weather. In the northern United States the little brown bat retires to its winter quarters sometime between the last of September and about the middle of October and reappears late in April or early May. This period is passed in the torpid sleep of hibernation. The ability to go into this state whenever the weather becomes too cold for insect life to be abroad is the only method by which these bats could exist on Kodiak and other islands along the south coast of Alaska, where the long-continued cold storms of summer would otherwise render existence impossible for them. Once on the highlands of Mexico, during a long period of cold, rainy weather, I found a bat in the hibernating condition hanging from the roof of a small cave shelter. It was completely torpid, but when held in my hand for two or three minutes it became wide-awake and struggled to escape. Such temporary suspension of activity in response to chilling weather is evidently very serviceable to these animals.

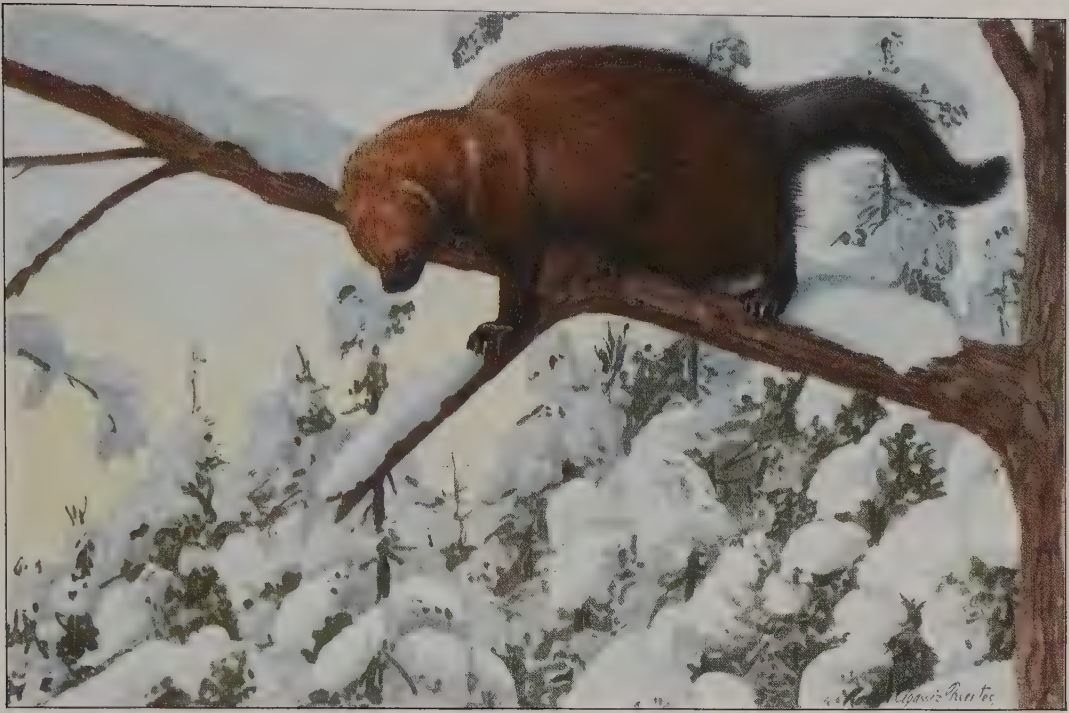
One careful observer who has had the opportunity for close-up study of a number of little brown bats found that they pay as much attention to their daily toilet as a cat. They lick their fur and the inside of their leathery wings, wherever they can reach with their tongues. They also moisten the rounded bend of the wing and twiddle it inside the ear as one might do with the tip of a finger. To get at some of the hair on the lower parts, the claw on the thumb at the bend of the wing is hooked into the loose skin to draw it up within reach of the tongue. To dress the fur on top of the head and back which cannot be reached by the tongue, the hind foot is moistened by licking and then, with extraordinary rapidity of motion, the hair is combed by the claws.

RED BAT: Nycteris borealis

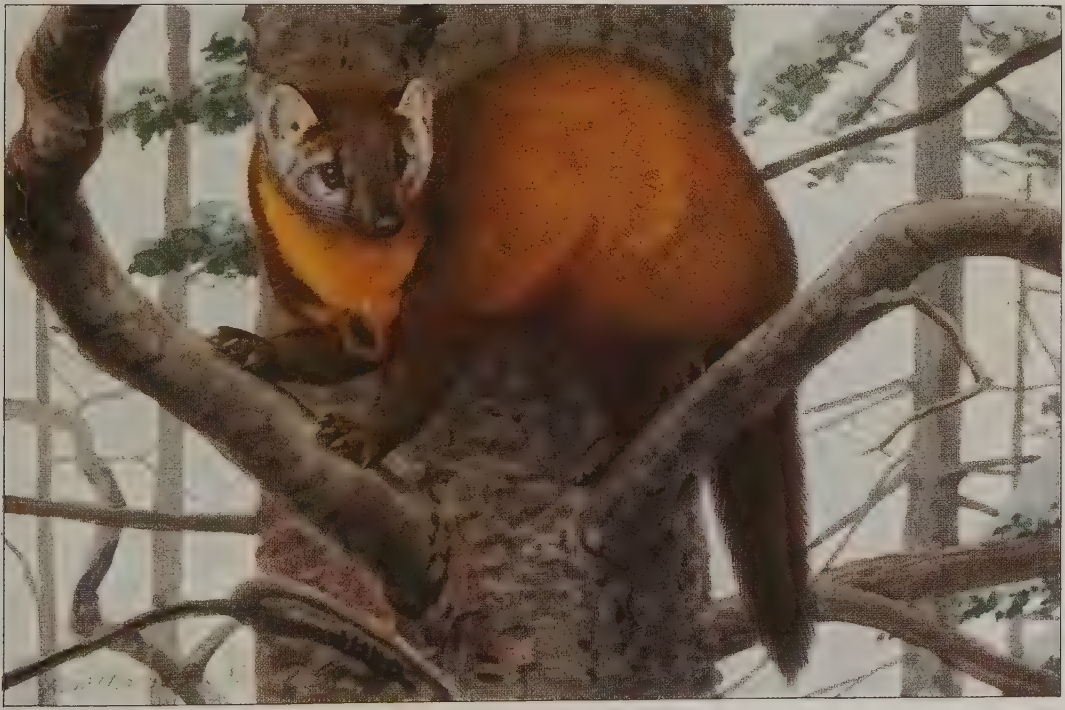
(*For illustration, see Color Plate, page* 37)

Bats reach their greatest development in the Tropics, where a marvelous variety of these curious mammals exists. To the northward the number of species gradually decreases, until eventually, in northern Canada and Alaska, a single species represents the group. The United States, occupying the middle latitudes, has a considerable number of different kinds. Some of these remain throughout the year, hibernating in caves during the period of cold, when insects are not to be had; others wing their way southward like birds on the approach of winter and return in spring.

All bats are nocturnal, although individuals of some species occasionally fly about for a time by day and many come out just before or soon after sunset. In this country nearly all



FISHER, or PEKAN
Martes pennanti



MARTEN, or AMERICAN SABLE
Martes americana

species are insectivorous, but in Mexico and the West Indies many are fruit eaters and a few true vampires or blood suckers.

As a rule, bats are clothed in dull colors, but richly tinted coats give a few a more attractive appearance. Of these none has a more striking adornment than that presented by the soft covering of glossy orange-red fur of the red bat. Its large size, about four inches in total length, a spread of wings amounting to twelve inches, and its color, all suffice to distinguish it at once from any other northern species.

The range of the red bat extends from the Atlantic coast to the Pacific and from Ontario and Alberta in southern Canada south throughout most of the United States to the Gulf coast and southern California; also beyond our limits to Lower California and Costa Rica. The genus to which this bat belongs ranges more widely in other parts of North America; also to South America and across the eastern Pacific to the Galápagos and Hawaiian Islands.

The red bat rarely or never seeks shelter in gloomy caves and crevices, but hangs to the small twigs or leaf stems on trees and bushes in the full light of the sun. One observer in Texas on July 4 found four of them hanging in a cluster from a twig on a peach tree, with the sun shining full on them, although the temperature in the shade was 82 degrees Fahrenheit. I have found them in northern Illinois in the glaring sunlight of May, hanging from leaves in the tops of oak trees. This unusual tolerance of light in a member of the bat tribe is further shown by its habit of beginning to hunt through the air for insects earlier in the afternoon than other species in its range.

Long, narrow wings and swift, powerful flight characterize the red bats in the air. They have marvelous control in darting and turning here and there, and no birds, except possibly the chimney swifts, can equal them in their extraordinary gyrations.

Red bats are known to migrate from the northern part of their range in September or October and to return in May. They have been seen going south at Cape Cod the last of August and in September; and late in October Dr. E. A. Mearns has recorded great flights of them down the Hudson Valley, lasting throughout the day. That they share the vicissitudes of migrating birds is indicated by observation on the New Jersey coast of stray, exhausted individuals coming in from the sea early on September mornings.

They are among the most solitary of their kind, usually being found hanging singly on a tree or bush, sometimes within a few feet of the ground. On occasion they gather in clusters as mentioned above, and in one instance in Maryland more than a dozen were hanging in a compact ball, which suddenly exploded into its winged parts when disturbed.

One of the most unusual characteristics of the red bat is found in the number of young it bears. Usually other species, except the hoary bat, have one or two young, but at varying dates between May and July each year the red bat produces from two to four, the average being three or four. The young when very small are carried clinging to the body of the mother in her flights. She continues to take them from place to place in this manner until their combined weight exceeds her own. The strength of the maternal feeling in this species is well illustrated by an instance in Philadelphia where a boy caught a half-grown red bat in a city square and carried it home. In the evening, three hours later, he crossed the same square, carrying the young bat in his hand, when the old one came circling about him and finally in her deep anxiety alighted on his breast. Both were brought in, the young one clinging to its mother's teat. The devoted mother received injuries when she was captured, from which she died two days later.

In the contact between mankind and bats, man, the invariable aggressor, finds the bats baring their teeth, biting viciously, squeaking, and behaving altogether like little fiends. A gentler side is sometimes exhibited, however, and one observer who caught a partly grown red bat found that it became tame, showed intelligence, and developed a friendly feeling for its captor.

HOARY BAT: Nycteris cinereus

The hoary bat is a close relative of the red bat, but is larger, being about five inches long, and, as its name implies, is of a different color. It is widely distributed over a large part of North America, where it is known to breed from Nova Scotia, Manitoba, and the southern shore of Great Slave Lake south practically throughout the United States. It is one of our larger species and is remarkable for its power and skill on the wing. The wings are long and narrow and carry their owner through the air in a bewildering series of swoops, curves, and zigzag turns remarkable even in a group of animals so notable for their powers of flight.

With the approach of cold weather the hoary bat migrates from the northern parts of its range to the milder southern districts. It is a late migrant, not leaving its northern home until the last of September or October and returning in May. Some individuals appear to remain in the North all winter, as one has been taken in Connecticut in December. In its southern flight it wanders as far as Jalisco, near the southern end of the Mexican table-land, to Lower California, and to the Bermuda Islands. To reach the Bermudas it is evident the bat must make a continuous flight from the nearest point on our shores of at least 580 miles—a good tribute to its wing power.

Like the red bat, it lives in the open, hanging from twigs and leaves in the tops of trees or bushes in the broad light of day rather than in the dark, stifling crevices where so many of its kind pass their lives. It appears to hang up indifferently on any convenient tree or bush, including conifers, aspens, and willows. During the day it has a curious lack of alertness, and as it is not rarely attached to low branches or bushes within a few feet of the ground it may be readily approached and taken in the hand. I once captured a fine specimen in southern California, hanging on a bush about four feet from the ground. It appeared to be sound asleep until taken by the skin on the back of the neck, when it became very much alive and, struggling in a fury, uttered grating shrieks of rage, bared its sharp, white teeth and tried desperately to bite.

Its food is made up entirely of insects, which it appears to hunt higher up than most bats, sweeping over the tops of the forest and in and out about the trees. It appears to be of even more solitary habits than the red bat and is nowhere so common. Another reason for our lack of information concerning it is found in its strictly nocturnal habits, for it rarely appears until shortly before the approaching night hides it from view.

The hoary bat shares with the red species the distinction of bearing from two to four young each year. The young are born in June and are carried attached to the underside of the mother's body until they become too heavy a burden. They hang to the teats with the greatest tenacity and apparently rely mainly on this hold to prevent being dropped as they are carried on the wild aërial hunting excursions. With the unusual fecundity indicated by the number of young, it is difficult to account for the scarcity of these bats, unless their habit of hanging in the open, exposed to the elements and to other dangers, causes a heavy mortality among them.

BIG-EARED DESERT BAT: Antrozous pallidus and its relatives

(*For illustration, see Color Plate, page* 39)

The marvelous variations in structure of the ears and other organs about the heads of insect-eating bats serve probably as microphones by which the flight of their prey may be detected and its direction located with instantaneous certainty. The beautiful accuracy with which this hearing mechanism works must be evident to anyone who will take a position where he may have the evening glow of the western sky as a background for flights of bats. It is certain that the small and ineffective eyes these animals possess could never locate their minute flying game and enable them to secure it in the whirling, zigzag courses they pursue, often at a speed and under a control which few, if any, birds could rival.

The great ears of the big-eared desert bats illustrate one form of a highly developed hearing apparatus and give these animals a handsome and strikingly picturesque appearance. This characteristic also at once distinguishes them from others of their kind in the United States.

The distribution of this species lies mainly in the arid parts of the Southwestern States and Mexico. It extends from western Texas, southern Colorado, Nevada, and Oregon, south to Querétaro, on the Mexican table-land, and to the southern end of the peninsula of Lower California. The vertical distribution extends from sea level up to at least 5,000 feet altitude.

By day these desert bats live in crevices and caves in cliffs, in old mining tunnels, hollows in trees, and in sheltered places about the roofs and walls of houses, barns, or other buildings. Their presence in dark hiding places may sometimes be detected by occasional grating squeaks. They appear to lack any of the musky odor which characterizes so many bats. About the first of June each year either one or two young are born, and for a time they cling to the mother's breast and are carried about during her swift flights in pursuit of insect prey.

Often when camping at desert waterholes, I have seen them come in just before dark to drink, scooping up water from the surface while in flight, and then circling back and forth over the damp ground at an elevation of a few yards for the capture of some of the insects common in such places. At such times, with the distant hills mantled in a deepening purple haze and the pulsating heat of the day replaced by the milder temperature of approaching night, these bats could often be seen sharply outlined against the rich orange afterglow of the departed sun. Here and there in the still air flickered and zigzagged multitudes of tiny bats, like black butterflies, and among them the occasional big-eared bats on broad wings appeared huge in contrast. Their wing strokes were slower and shorter than those of the smaller species and impelled them forward in a swift, gliding movement which gave their evolutions a sweeping grace beautiful to see.

In August some years ago, during a visit to the Indian School at Tuba, in the Painted Desert of northern Arizona, I found these bats living in considerable numbers about the buildings. Just before dark they swarmed out and hunted in the surrounding orchards and small fields. One evening my collector shot at one as it circled over a potato field in a small orchard. It continued its flight, circled low among the apple trees as though unhurt, when suddenly it dropped to the ground. Supposing the bat to be wounded, it was cautiously approached and covered with a hat, when, without a struggle, it permitted itself to be picked up by the nape. It then became evident that the bat was unhurt from the shot. The reason for its sudden descent was revealed in the presence of a large, fat mole cricket (*Gryllotalpa cultriger*) which it was holding firmly in its jaws. So ferociously intent was it in biting and worrying its luscious prey that it paid not the slightest attention to its captor. Finally it was killed by having its chest compressed and died with its bulldog grip on the cricket unbroken.

These bats, like the other members of the tribe in the United States, are fully as beneficial to the farmer as the best of our insect-eating birds and deserve equal protection in place of the general persecution from which they now suffer.

FREE-TAILED MEXICAN BAT: Tadarida mexicana and its subspecies

(*For illustration, see Color Plate, page* 39)

Of the mammals of tropical origin which have invaded our southern border, the Mexican bat is a notable member. It differs in many curious ways from the bats with which it associates in temperate regions. One of the marked differences distinguishing it from the other bats described here is the flattening of the head and

Photograph by Clifton Adams

MARY AND HER 'POSSUM IN A FLOOD REFUGEE CAMP AT VICKSBURG, MISSISSIPPI

"I don't know where they came from, but yesterday morning, when I woke up, there they were, five of them, on the other cot in my tent. Yes, the others got away."

body which enables it to creep into a surprisingly narrow crevice in the rocks or elsewhere. The ears are broad and flaring and extend forward over the eyes like the visor of a cap, and the end of the tail is not confined within the membrane extending between the hind legs, but projects from it. Another pronounced and highly disagreeable characteristic of this bat is its rank musky odor. This pollutes the air about its harboring places, rendering it a most unwelcome guest.

Whoever has visited the Southern and Southwestern States or Mexico must have noted the offensive odor in many places about the verandas of houses and especially about old churches and other public buildings. This is the sign of occupancy placed on the premises by the Mexican bats, which, to the number of a few dozens or actually by thousands, as conditions permit, may lie snugly hidden in cracks and dark openings of all kinds about the roof and walls. No other bat in Mexico or the United States is provided with so strong an odor.

The Mexican bat is extremely abundant, probably exceeding in numbers any other species within its territory. It ranges throughout the tropical and lower temperate parts of Guatemala, Mexico, and across our border, throughout most of Texas, and east as far as Florida and South Carolina; in the West it also abounds both in town and country in the warmer parts of New Mexico, Arizona, and California.

Closely allied relatives of the Mexican bat abound throughout the warmer parts of Central and South America to beyond Brazil. The genus to which this species belongs is represented in the warmer parts of both hemispheres. It extends north in the Old World to southern Europe and also is found in the Philippines.

The abundance of the Mexican bat in some favorable places is almost incredible. At Tucson, Arizona, I once saw them, a short time before dark, issuing from a small window in the gable of a church in such numbers that in the half light they gave the appearance of smoke pouring out of the opening. At times they occupy houses in such numbers that their presence and accompanying offensive odor render the places uninhabitable. At the town of Patzcuaro, near the southern end of the Mexican table-land, I saw two rooms in an old adobe house occupied by as many of them as could possibly hang from the rough ceiling. The owner considered their presence a valuable asset, as he collected and sold the guano for more than the rooms would have brought in rent. The bats congregate in even greater numbers in large caves. So numerous are they in certain caves in Texas that the owner reported an annual income of about $7,000 from the guano.

They are very plentiful by day in the thin crevices about the roof and walls of caves in the celebrated Ixtapalapa, or "Hill of the Star," beyond the floating gardens near the City of Mex-

A DEER FINDS SAFETY ON A MISSISSIPPI LEVEE

During one of the recent disastrous floods in the Mississippi Valley, kind-hearted refugees helped many exhausted animals to high ground.

ico, and I also found them living in many of the marvelous ruins of Mexico, including Chichen Itzá, in Yucatan. Wherever they occur in numbers they may be heard frequently by day shuffling uneasily about and squeaking shrilly at one another.

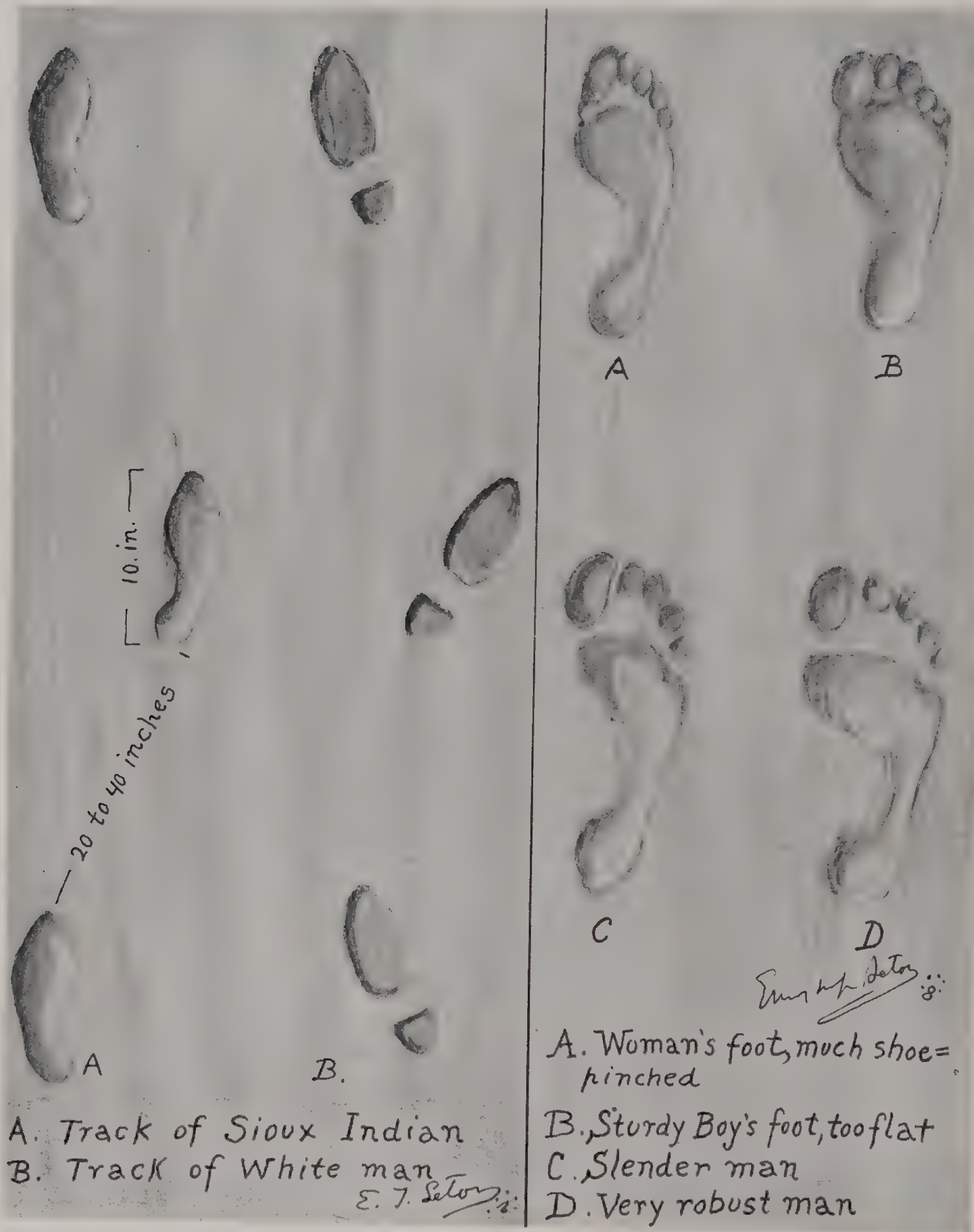
When they first come out after sunset they usually fly away in a great stream, nearly all in the same direction, as though migrating. Their course will probably be found leading to water, where they scoop up a drink from the surface before beginning their wonderfully erratic zigzags through the air in pursuit of insects.

From the colder northern parts of their range they migrate southward to milder climatic conditions or descend to lower altitudes. In Mexico, where they live up to above 8,000 feet altitude, they move down from one to two thousand feet. Their young, one at a birth, are born from April to May.

It has been claimed that the Mexican bat brings bedbugs to infest houses. This is untrue of this or any other bat. These animals have certain small parasites, some of which, resembling small bedbugs, have probably given rise to the belief mentioned. These parasites live only on the bats.

Considerable publicity has been given to the supposed possibility of utilizing bats to destroy mosquitoes and thus eliminate malaria from infested areas. One or more bat houses have been built at San Antonio, Texas, for the purpose of assembling bats in large numbers, and many untenable claims have been put forth concerning the benefit to be derived from their services. The Mexican bat is the species which abounds above all others at San Antonio and is the principal species which has occupied one bat house near town. It is definitely known that bats often fly miles from their roosts when feeding and do not concentrate on any one kind of insect. Examination of the contents of the stomachs of Mexican bats shows that they feed on beetles and numerous other insects, but rarely upon mosquitoes. I have visited many Mexican towns and villages in which every house was haunted by numbers of these bats and where malaria was perennial. The evidence against these animals serving any useful purpose in checking malaria is conclusive.

It may be repeated here, however, that all bats in the United States are of high utility as insect-destroyers and should be protected. Among the many species of varying habits which exist in this country, a few make their homes about houses in annoying numbers. Instead of killing them to abate the nuisance, it would be better to exclude them from buildings by closing the entrance ways promptly after all have left in the evening, and thus by quiet eviction cause them to find abiding places elsewhere. The destruction of forests, and the consequent absence of the hollow trees where they formerly lived, is mainly responsible for bats and chimney swifts coming to houses for harbor.


10. in.
20 to 40 inches
A
B.
A. Track of Sioux Indian
B. Track of White man
E. T. Seton
A
B
C
D
A. Woman's foot, much shoe=pinched
B. Sturdy Boy's foot, too flat
C. Slender man
D. Very robust man

THE HUMAN FOOTPRINTS

The footprints of the human animal are included in this series of sketches for the purpose of comparison. Especially interesting is the similarity to be noted between the tracks made by man and those of the grizzly (see page 57) and the black bear (page 55). The tracks shown on the left half of this page present the moccasin-shod footprints of a Sioux Indian compared with the shoe tracks of a white man. On the right are shown: (A) a woman's foot which has been much pinched by tight shoes; (B) a sturdy boy's foot, somewhat too flat to be normal; (C) the footprint of a slender man, and (D) the imprint of a robust man's foot.

CHAPTER IV

The Bears, Raccoons, Ring-tailed Cats, Martens, Fisher, Mink, Black-footed Ferret, Wolverine, Land and Sea Otters, Skunks and Badgers

THE carnivores, or flesh eaters, forming the Order *Carnivora,* occur in all parts of the world, except on many oceanic islands, and include most of the beasts of prey, both great and small. They vary in size from the least weasel, weighing perhaps a couple of ounces, to the giant brown bear of Alaska (see frontispiece), weighing approximately 1,500 pounds or more. Many carnivores are well known, such as the bears, dogs, wolves, the sable, and others of the weasel kind, lions, tigers, and many other cats.

These beasts have always been of special interest to man, for some of the great cats have hunted him as their prey, even down to the present time in remote parts of India and Africa. Others he has had to conquer in order to protect himself and his domestic animals from their ravages while he has been engaged in taming the wilderness. Many of the smaller kinds have from early times supplied warm and beautiful fur garments for his comfort and adornment.

Bears (Family *Ursidæ*) occur in nearly all of the cooler parts of the world except Africa, Australasia, and southern South America. While varying considerably in size, the members of the group have an unusually close general resemblance in form and habits. All are armed with strong claws which are used effectively in obtaining their food.

The black bears, Genus *Euarctos,* are peculiar to North America, from middle Mexico to the forests near the Arctic Circle. They have comparatively short, sharp claws which enable them to climb trees with great facility. They have an exceedingly close general resemblance in all parts of their range and may prove to consist of a single species broken into a number of subspecies in various geographic areas.

The brown bears of the Old World, as well as the grizzlies and the big brown bears of North America, Genus *Ursus,* are usually larger than the black bears and all are characterized by the possession of such long, slightly curved claws that the adults are unable to climb trees. This group has attained its greatest development in North America, where a considerable number of species have been described. They are much more powerful and aggressive than the black bears, which run from them in fear when they chance to meet.

The great white bear of the northern ice pack is the only member of the Genus *Thalarctos.* It is claimed that it is recognizably different in various parts of its range, thus indicating the existence of subspecies of which a number have been named.

RACCOONS AND THEIR ALLIES

All of the raccoons and their allies of the Family *Procyonidæ* are distinctively American. The group is well represented in both the Northern and Southern continents, but reaches its greatest development in the Tropics. It includes the raccoons, the nasuas, or coatimundis, the rare Bassaricyon, and the curious woolly-haired kinkajou, a night-prowling creature with a prehensile tail, living in the tree tops of tropical forests. All the members of this family (Procyonidæ) are readily tamed and make affectionate and amusing pets.

The raccoons, Genus *Procyon,* are the largest and most robustly built members of their family, as well as the most widely distributed. The well-known raccoon described on page 59 is the northernmost of the two types of species in this genus. The other, the crab-eating raccoon, lives in Central and South America.

Two slender North American species of mammals much like long, thin-bodied house cats in form, but with much longer tails, are the only living representatives of the Family *Bassariscidæ.* They are omnivorous, like raccoons, their relationship to which is suggested by the similarity of the strongly marked black and light bands across their tails. They live in temperate and tropical climates from southern Oregon to Panama.

The northern species of the Genus *Bassariscus* is described on page 60. The larger southern one is much like it in general appearance, but is darker and frequents tropical forests, where it hunts through the tree tops at night.

WEASELS AND THEIR ALLIES

The weasel family, *Mustelidæ,* comprises one of the most dominant groups of mammals now in existence. Its members are distributed over all the continents except Australia. Although none of the species are large, they are such fierce and persistent killers of other animal life that they carry terror and destruction among the smaller wild things wherever they go. They are specially numerous in the northern temperate regions. In North America they are represented by the weasels, mink, marten, fisher, otter, skunk, badger, and wolverine.

Martens, or sables, Genus *Martes,* are characteristic of circumpolar forests and range down the mountains into the United States. The Siberian marten has long been celebrated as one of the finest fur producers in the world, excelling in this its close relative in America.

The Genus *Mustela* contains those small, slender-bodied, bloodthirsty little beasts variously known as weasels, or ermine when in the white winter coat, and stoats, which together may be termed the true weasels. With them are grouped the much larger mink and black-footed ferret in North America. Representatives of the larger true weasels range down to northern South America, but all other American members of the group occur only north of the Mexican boundary. All of the American members of the genus have close relatives in Europe and northern Asia.

In its short, massively built body the wolverine, Genus *Gulo,* the only specific type in this genus, presents a strong contrast to the slender, agile forms of many other members of the weasel family, as well as to the true weasels. It is circumpolar in distribution.

The land otters, Genus *Lutra,* present a modification of the usual weasel form for adaptation to life in the water. They have a widespread distribution, occurring in North and South America as well as in Europe, Asia, and Africa.

The land otters have adapted the weasel body to life in fresh water, in some localities also frequenting rocky sea coasts, but the sea otters, Genus *Enhydra,* have become fitted for life in stormy northern seas, often far from shore. Only one species, with its subspecies, is known.

SKUNKS FORM A DISTINCTIVE AMERICAN SECTION OF THE WEASEL FAMILY

The skunks form a distinctively American section of the weasel family. They are divided into three groups, of which the members of the Genus *Spilogale* are the smallest and handsomest. A number of species and subspecies are known, all from Central and North America.

Skunks of the Genus *Mephitis* are marked by broad white stripes or bands extending lengthwise along the upper parts of their black bodies and their large, bushy, black and white tails. They are widely distributed from Guatemala north into Canada.

Hog-nosed skunks, Genus *Conepatus,* have a more robust or powerful form than the others, evidently for the purpose of enabling them to use their modified snout more effectively in rooting. Other distinguishing characters of the North American species are their heavy claws and the white stripe down the middle of the back. Most of the members of this group occur in South America.

Although the American badger, Genus *Taxidea,* has much similarity in form, appearance, and habits to the Old World badgers, it has certain structural differences that set it apart from them. Only a single species, with a number of subspecies, is known in America.

BLACK BEAR: Euarctos americanus and its subspecies

(*For illustration, see Color Plate, page* 41)

Several genera and species of bears more or less uniformly black in color occur in North and South America and in Asia. In North America a black bear remarkably uniform in general appearance and probably belonging to a single species divided into geographic subspecies in various parts of its range, is generally distributed throughout the forested areas from the borders of the Arctic Barrens, at the northern limit of trees, south throughout the United States and down the wooded Sierra Madre to Jalisco, Mexico, and from Newfoundland on the east to the Queen Charlotte Islands on the west.

These bears are usually entirely black, except for a brown patch covering the muzzle and an occasional white spot on the breast. Their weight is variable, the largest ones exceeding 500 pounds, but they average much less.

The cinnamon bear, so common in the West and Northwest, long supposed to be a distinct species, has proved to be merely a color phase of the black bear—cinnamon cubs being born in the same litters with black ones.

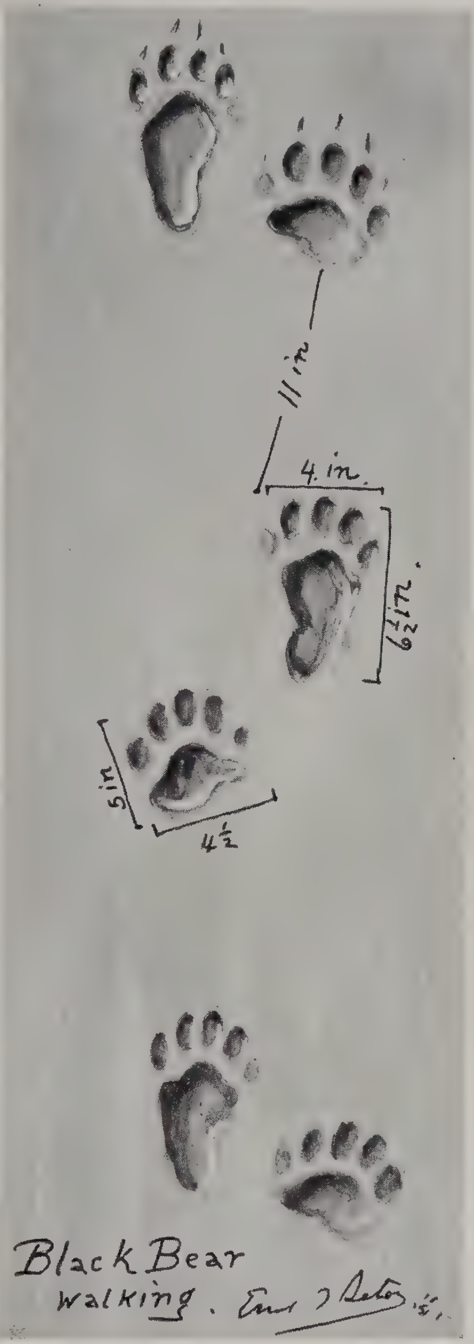
Since the days of primitive man and the great cave bear, the ways of bears have had a fearsome interest to mankind. Childhood revels in the delicious thrills of bear stories and dwells with wonder on the habit bears have of standing upright like droll caricatures of man, on the manlike tracks of their hind feet, and on their fondness for sweets and other palatable food.

From the landing of the first colonists on our shores, hunters and settlers have encountered black bears so frequently that these are among the best-known large forest animals of the continent. During winter they hibernate for months, seeking a hollow tree, a low cave, the half shelter of fallen tree trunks and brush, or else digging a den for themselves. The female chooses a specially snug den, where in midwinter from one to four cubs are born. At birth the young, only 8 or 9 inches long, are practically naked and have their eyes closed. They are so undeveloped at this time that it is more than a month before their eyes open and more than two months before they can follow their mother.

Although powerful beasts, black bears are so shy and timid that to approach them requires the greatest skill on the part of a still hunter. They attack people only when wounded or so cornered that they must defend themselves or their young. To safeguard themselves from danger, they rely mainly on a fine sense of hearing and an exquisite delicacy of smell. They have poor eyesight, and where a suspicious object is seen, but no sound or scent can be noted, they sometimes rise on their hind feet and look long and carefully before retreating.

To bears in the forest everything is game. They often spend the entire day turning over stones to lick up the ants and other insects sheltered there, and at night may visit settlers' cabins and carry off pigs. They raid the settlers' cornfields for green corn and are passionately fond of honey, robbing bee trees whenever possible. In season they delight in wild cherries, blueberries, and other fruits, as well as beechnuts, acorns, and piñon nuts. They are mainly nocturnal, but in districts where they are not much disturbed, they wander widely by day

The success of black bears in caring for themselves is well demonstrated by the numbers which still survive in the woods of Maine, New York, and other long-settled States. Their harmlessness and their exceeding interest to all render them worthy of careful protection. They should be classed as game and thoroughly protected as such, except for certain open seasons.



THE BLACK BEAR'S HIND FOOT OFTEN REGISTERS WITH THE FRONT

The foot of a black bear differs from that of a grizzly both in size and in the shortness of the claws (see page 57). Usually no claws show, and the fifth toe, which is well developed on both front and hind paws, leaves little sign and often none at all.
]

If this is done throughout the country, as is now the case in certain States, the survival of one of our most characteristic large wild animals will be assured.

GLACIER BEAR: Euarctos emmonsii

(For illustration, see Color Plate, page 41)

When first discovered, the glacier bear was supposed to be a distinct and well-marked species. Recently cubs representing the glacier bear and typically black bears have been found in the same litter, thus apparently proving it to be merely a color phase of the black bear. Its color varies exceedingly, from a light smoky, almost bluish, gray to a dark iron gray, becoming almost black. Some individuals are extraordinary appearing beasts, quite unlike any other bear in color. The interest in this curious color development is increased by the animal's restricted distribution.

The glacier bear is an Alaskan animal, occupying the seaward front of the St. Elias Range, about Yakutat Bay, thence southeast to Glacier Bay and a short distance beyond toward the interior. The popular name of this bear was well chosen, as its home is in the midst of innumerable stupendous glaciers. Here, where the contours of gigantic mountain ranges are being steadily remade by glaciers, Nature appears to have begun the evolution of a new kind of bear. That the task is in progress is evidenced by the excessive variation in color, scarcely two individuals being the same.

The food of this bear consists largely of mice, ground squirrels, and marmots, which it digs from their burrows on the high mountain slopes. Its food is varied by salmon during the spawning season and by various herbs and berries during the summer. The winters in the home of the glacier bear are less severe than across the range in the interior, but are so long and stormy that the bear must spend more than six months each year in hibernation.

Owing to the remote and little-frequented region occupied by this bear, little is known of its life history. For this reason it is important that all sportsmen visiting its country bring back careful and detailed records of their observations. Up to the present time, so few white men have killed glacier bears that a skin of one taken by fair stalking is a highly prized trophy. As the glacier-bear country becomes more accessible, more stringent protection will be needed to prevent the extermination of these unique animals.

GRIZZLY BEAR: Ursus horribilis and its relatives

(For illustration, see Color Plate, page 42)

Recent research has shown that the popular terms "grizzly," or "silvertip," cover a group containing numerous species of large bears peculiar to North America, some of which, especially in California, have become extinct within the last 25 years. These bears vary much in size, some about equaling the black bear and others attaining a weight of more than 1,000 pounds. They vary in color from a pale, dull buffy shade to nearly black, usually with lighter tips to the hairs, which produce the characteristic grizzled or silver-tipped appearance upon which the common names are based.

The strongest and most distinctive external character of the grizzlies is the long, proportionately slender, and slightly curved claws on the front feet, sometimes more than three inches in length.

Grizzly bears have a wide range—from the Arctic coast of Alaska southward, in a belt extending from the Rocky Mountains to the Pacific, through western Canada and the United States, and thence along the Sierra Madre of Mexico to southern Durango. They also occupy the Barren Grounds of northern Canada, and vague reports of a large brown bear in the interior of the peninsula of Labrador indicate the possibility of the existence there of an unknown species of grizzly.

From the days of the earliest explorers of the Rocky Mountain region, grizzly bears have borne the undisputed title of America's fiercest and most dangerous big game. In early days, having little fear of the primitive weapons of the Indians, they were bold and indifferent to the presence of man, and no higher badge of supreme courage and prowess could be gained by a warrior than a necklace of grizzly claws.

Since the advent of white men with guns, conditions have changed so adversely to the grizzlies that they have become extremely shy, and the slightest unusual noise or other alarm causes them to dash away at a lumbering, but surprisingly rapid, gallop. The deadly modern gun has produced this instinctive reaction for self-preservation. It does not mean, however, that grizzlies have lost their claim to the respect of even the best of hunters. They are still considered dangerous, and even in recent years experienced hunters have been killed or severely mauled by them. They are much more intelligent than the black bear, and thus, when wounded, are a more dangerous foe.

Like the black bear, the grizzlies are commonly nocturnal, but in remote districts they often wander about in search of food by day. They roll over stones and tear open rotten wood in search of grubs and insects. They also dig out ground squirrels and other rodents and eat a variety of acorns and other wild nuts and fruits. As an offset to this lowly diet, many powerful old grizzlies, from the Rocky Mountains to California, have become notorious cattle-killers. They stalk cattle at night, and, seizing their prey by the head, usually break its neck, but sometimes hold and kill it by biting. A few of these cattle-killing grizzlies still occur on the Western ranges. One or more wily marauders of this kind ran for years with a bounty of $1,000 on their heads.

Like other bears, grizzlies hibernate in winter, seeking small caves or other shelter, and sometimes digging a den in the ground. The young, from one to four in number, are born in midwinter and are very small, naked, and but partly developed at birth. They go about with the mother throughout the summer and commonly den up with her the following winter. Although full-grown grizzlies are ordinarily solitary in habits, parties of from four to eight are sometimes seen. The object of these curious but probably brief companionships is not known.

Grizzlies are disappearing so rapidly that it is very desirable that they be placed on the list of game protected during part of the year, except in the case of the few individuals which become stock-killers. They are among the finest of native animals and their absence from the rugged slopes of the Western mountains would leave a serious gap in our wild life

ALASKAN BROWN BEAR: Ursus gyas and its relatives

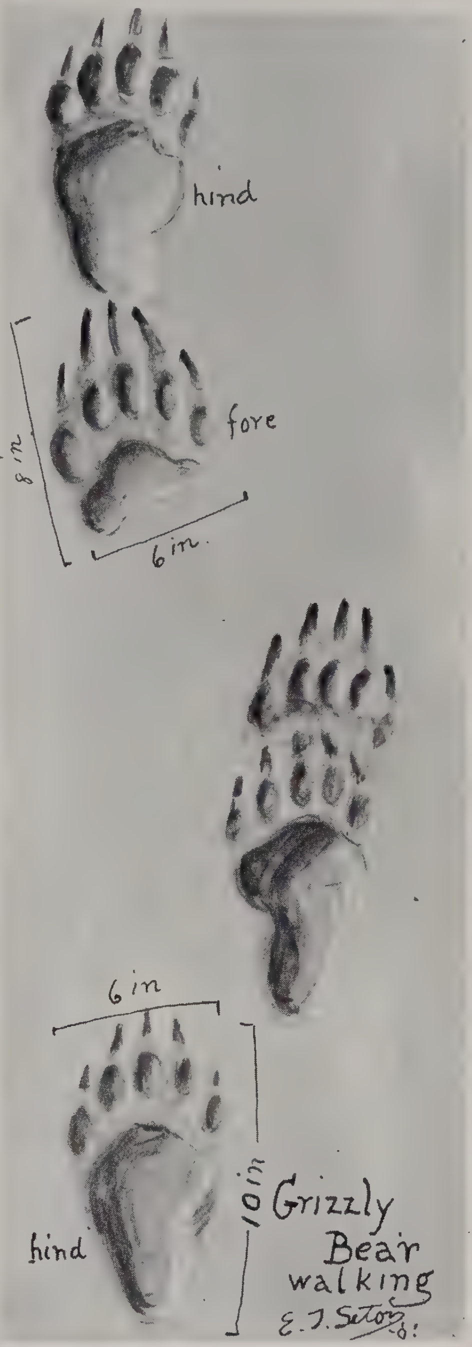
(*See frontispiece for the illustration of this remarkable animal*)

The Alaskan brown bears form a group of gigantic animals peculiar to North America and limited to the coast and islands of Alaska, from the head of Norton Sound to the Sitka islands. The group includes a number of species, individuals of two of which, *Ursus gyas,* of the Alaska Peninsula, and *Ursus middendorffi,* of Kodiak Island, sometimes attain a weight of 1,500 pounds or more, and are not only the largest existing bears, but are the largest living carnivores in the world. They can be likened only to the great cave bears which were the haunting terror of primitive mankind during the Old Stone Age in Europe. Brown bears still exist in Europe and Asia, but they form a distinct group of much smaller animals than the American species.

The Alaskan brown bears vary much in color, from a dull golden-yellowish shade to a dusky brown, becoming almost black in some species. In color some of the darker species are indistinguishable from the great grizzlies, with which in places they share their range; but the relatively shorter, thicker, and more strongly curved claws on the front feet of the brown bears are distinctive.

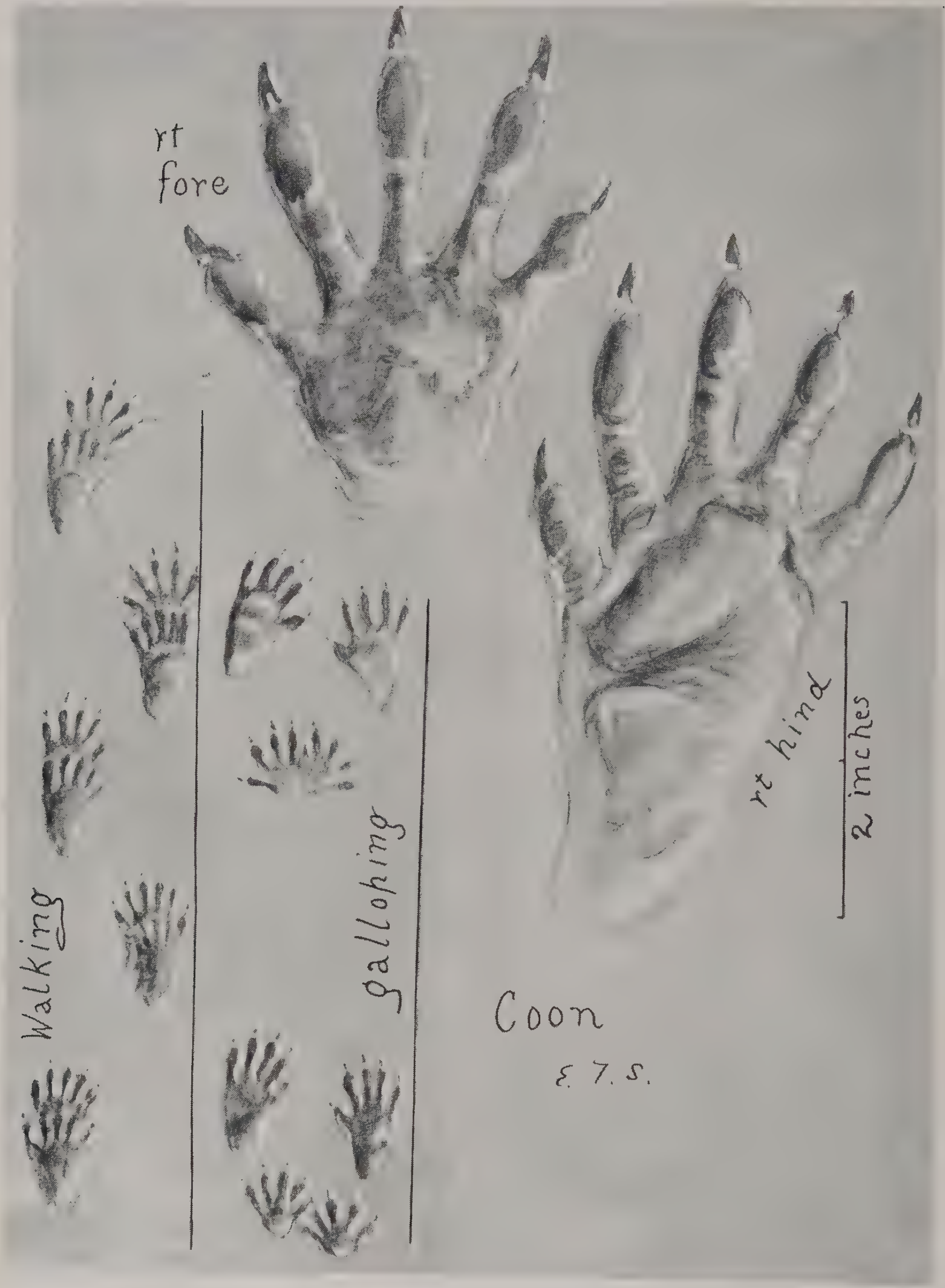
As a rule they are inoffensive giants and take flight at the first sign of man. The taint left by a man's recent track or the faintest odor on the passing breeze, indicating the proximity of their dreaded enemy, is enough to start the largest of them in instant flight. Instances are reported of their having attacked people wantonly, but such cases are extremely rare. When wounded or suddenly surprised at close quarters, the instinct of self-defense not infrequently incites them to attack their enemy with furious energy. Many Indian and white hunters have been killed or terribly mauled by them in such encounters. At close quarters their great size, strength, and activity—astonishing for such apparently clumsy beasts—render them terrific antagonists.

Some of the species occupy open, rolling, or hilly tundras, and others live on the steepest and most rugged mountain slopes amid glaciers, rock slides, and perpetual snow-banks. On the approach of winter all retreat to dry locations, usually in the hills, where they dig dens in the earth or seek other cover to which they retire to hibernate. Here the young, usually two or three in number, are born. They ordinarily



GRIZZLY BEAR TRACKS THRILL THE BIG-GAME HUNTER

The great size and the immense claws are the chief characteristics of the grizzly's track, in which all five toes usually show. California grizzly tracks, once often seen in dusty trails leading through their haunts, sometimes measured 12 inches or more without the claws.


rt fore
rt hind
2 inches
Walking
galloping
Coon
E. T. S.

A RACCOON'S TRACK IS DISTINCTIVE

It is usually easy to find, because the animal frequents the mud by the water side. Raccoons patrol the border of streams and lakes so persistently that where they are common they sometimes make well-trodden little trails. At a casual glance, the track of a small coon may be mistaken for that of a large muskrat (see illustration, page 179), but their differences are obvious.

emerge from hibernation in April or early May and wander about over the snow-covered hills and mountains. At this time their dark forms and their great tracks in the snow are so conspicuous that hunters have little difficulty in finding them.

Despite their size, brown bears devote much of their time to hunting such game as mice, ground squirrels, and marmots, which they dig from their burrows with extraordinary rapidity. During the salmon season, when the streams swarm with fish, bears frequent the lowlands and make trails along the watercourses, where they feed fat on this easy prey. During the summer and fall these great carnivores have the strange habit of grazing like cattle on the heavy grasslike growth of sedge in the lowland flats and benches, and also of eating many other plants.

Although Alaska was long occupied by the Russians and has been a part of our territory since 1867, not until 1898 was there any definite public knowledge concerning the existence of these bears, notwithstanding their size and abundance. Since that time they have become well known to sportsmen and others as one of the wonders of the remarkable region they occupy. Their comparatively limited and easily accessible territory renders their future precarious unless proper measures for their reasonable protection are continued. They are certain to be exterminated near settlements; but there are ample wild and inhospitable areas where they may range in all their original freedom for centuries to come, provided man permits.

POLAR BEAR: Thalarctos maritimus

(*For illustration, see Color Plate, page* 40)

Both summer and winter the great ice bear of the Far North is appropriately clothed in white. It is also distinguished from all other bears by its long neck, slender, pointed head, and the quantity of fur on the soles of its feet. It is a circumpolar species, the limits of whose range nearly everywhere coincide with the southern border of the pack ice. The great majority live permanently on the ice, often hundreds of miles from the nearest land.

During summer the polar bear keeps mainly on the ice, but in winter it more commonly extends its wanderings to the Arctic islands and the bordering mainland coasts. In winter it ranges southward with the extension of the ice pack. In spring, by an unexpectedly sudden retreat of the ice, individual bears are often left south of their usual summer haunts, sometimes being found swimming in the open sea far off the coast of Labrador. Occasionally some of those which migrate southward with the ice through Bering Strait fail to turn north early enough and are stranded on islands in Bering Sea.

That a carnivore requiring so much food as does the polar bear can maintain itself on the frozen Polar sea is one of the marvels of adaptation to environment. The activity of these bears through the long black night of the Far North is proved by records of Arctic explorers, whose caches have been destroyed and ships visited by them during that season. In this period of privation they range far over land and ice in search of food, and when in desperate need do not hesitate to attack men. I have seen several Eskimos who had been seriously injured in such encounters, and learned of other instances along the Arctic coast of Alaska in which hunters had been killed on the sea ice in winter. During the summer season of plenty, polar bears are mild and inoffensive, so far as men are concerned. At that time they wander over the pack ice, swimming in open leads, and, when hungry, killing a seal or young walrus.

When spring opens, many polar bears are near the Arctic coast. At that time, the natives along the northeast coast of Siberia kill many of them on the ice with dogs and short-hafted, long-bladed lances. The dogs bring the bear to bay, and the hunter, watching his opportunity, runs in and thrusts the lance through its heart.

During the cruise of the *Corwin* we saw many of these bears on the broken ice off Herald and Wrangell Islands. One large old male climbed to the top of an uptilted ice pan. After looking about, he lay down on one side and, giving a push with one hind foot, slid down head foremost 30 or 40 feet, striking the water with a great splash. He then climbed out and walked sedately away.

Another bear saw a seal basking on the ice by a large patch of open water and, swimming across, suddenly raised himself half out of the water at the edge of the ice, and by a blow of his paw crushed the seal's skull. He then climbed out and made a feast within 500 yards of where the *Corwin* was anchored to the ice pack.

Once, while we were anchored in a dense fog several miles off the pack, a bear came swimming out to us, stopping every now and then to raise his head high out of water to sniff the attractive odors from the ship. Although strong and tireless swimmers, these bears lack the necessary speed to capture their prey in the water.

The female retires in winter to a snug den among the hummocks on the sea ice, where one or two naked cubs are born, which by the time the ice begins to break up are ready to follow the mother. Until the cubs are well grown, the mother cares for and defends them with the most reckless disregard for her own safety. On one occasion I saw a wounded mother bear shield her cub, twice the size of a Newfoundland dog, when bullets began to strike the water about them, by swimming straight away with the cub safely sheltered between her forelegs.

The inaccessible character of so large a part of the home of the polar bear will long preserve it from the extermination that is overtaking some of the land bears.

RACCOON: Procyon lotor and its subspecies

(*For illustration, see Color Plate, page* 33)

Few American wild animals are more widely known or excite more popular interest than the raccoon. It is a short, heavily built animal with a club-shaped tail, and with hind feet that rest flat on the ground, like those of a bear, and make tracks that have a curious resemblance to those of a very small child. Its front toes are long and well separated, thus permitting the use of the front feet with almost the facility of a monkey's hands.

Raccoons occupy most of the wooded parts of North America from the southern border of Canada to Panama, with the exception of the higher mountain ranges. In the United States they are most plentiful in the Southeastern and Gulf States and on the Pacific coast. Under the varying climatic conditions of their great range, a number of geographic races have developed, all of which have a close general resemblance in habits and appearance.

Throughout their range they seek the wooded shores of streams and lakes and the bordering lowland forests. They are expert tree-climbers, commonly having their dens in hollow trees, often in cavities high above the ground. Here they have annually from four to six young, which continue to frequent this retreat until well grown, thus accounting for the numbers often found in the same cavity. Although they are tree-frequenting animals, the greater part of their activities is confined to the ground, especially along the margins of watercourses. While almost wholly nocturnal in habits, they are occasionally encountered abroad during the day.

Their diet is extraordinarily varied, and includes fresh-water clams, crawfish, frogs, turtles, birds and their eggs, poultry, nuts, fruits, and green corn. When near water they have a curious and unique habit of washing their food before eating it. Their fondness for green corn leads them into frequent danger, for when bottom-land cornfields tempt them away from their usual haunts, raccoon hunting with dogs at night becomes an especially favored sport.

Raccoons are extraordinarily intelligent animals and make interesting and amusing pets. During captivity their restless intelligence is shown by the curiosity with which they carefully examine every strange object. They are particularly attracted by anything bright or shining, and a piece of tin fastened to the pan of a trap serves as a successful lure in trapping them.

They patrol the border of streams and lakes so persistently that where they are common they sometimes make well-trodden little trails. Many opened mussel shells or other signs of their feasts may be found on the tops of fallen logs or about stones projecting above the water. In the northern part of their range they hibernate during the coldest parts of the winter, but in the South they are active throughout the year.

Raccoons began to figure in our frontier literature at an early date. "Coonskin" caps, with the ringed tails hanging like plumes, made the favorite headgear of many pioneer hunters, and coonskins were a recognized article of barter at country stores. Now that the increasing occupation of the country is crowding out more and more of our wild life, it is a pleasure to note the persistence with which these characteristic and interesting animals continue to hold their own in so much of their original range.

RING-TAILED CAT: Bassariscus astutus
and its relatives

(For illustration, see Color Plate, page 44)

The mild climate and the proximity of the Southwestern States to Mexico and the Tropics bring within our borders numerous strange types of wild life. Of these the ring-tailed cats are among the most strikingly marked and interesting. In the United States they are known by several other names, including "civet cat," "coon cat," and "band-tailed cat." In Mexico they still bear the old Aztec name "cacomixtle," except in Lower California, where they are "babisuris." They are about the size of a large cat, but with proportionately longer and slenderer bodies, shorter legs, and longer tails. The alternating bands of black and white on the tail proclaim relationship, not to the cat, to which they have no kinship, but to the raccoon, which has a tail similarly marked. Few mammals possess such a beautifully formed head and face, and their large, mild eyes give them a vivid expression of intelligence.

The ring-tailed cats occupy areas under such differing climates as to produce geographic races, but none of them varies strikingly from the typical animal here illustrated. They range from Oregon, Nevada, southern Utah, Colorado, and Texas south to Panama. In Mexico they occur from near sea level up to an altitude of about 10,000 feet. While chiefly rock-inhabiting species, they sometimes live in the forests. As a rule, they make their dens in caves and deep crevices, but sometimes in hollow trees or about houses. Their young, from three to four in number, are born in May or June.

In the Southwest they frequent some of the ruined cliff dwellings, and I have found them haunting many of the ancient ruins of Mexico. Their presence in little caves and other sheltered spots along cliffs and rock walls bordering canyons or on mountain slopes may usually be known by an examination of the fine dust which accumulates in sheltered places. Whenever present, their delicate, catlike tracks will be found where they have been hunting mice or other small game.

Strictly nocturnal, they do not sally forth from their dens until darkness is complete. During the night they are restless and frequently wander far and wide in search of food, and apparently at times merely to satisfy a spirit of inquiry. Their inquisitive nature frequently leads them to explore the streets of towns and cities on the Mexican table-land, filled though these places are with dogs. At daybreak, tracks left in the dusty streets tell the story of their wanderings, as they often do also in the case of opossums.

One morning in February, 1893, soon after sunrise, I chanced to pass through a little wooded square in Mexico City and saw a group of boys pursue and capture one of these animals which, having overstayed its time, had been surprised by daybreak. This wanderer might have had its den in some house in the neighborhood, since one of its known habits is to take up its abode about houses, even in the midst of towns. A friend living in Mexico City informed me that after having been annoyed for some time by noises on the roof at night, he investigated and discovered a female cacomixtle with partly grown young snugly located in a nest placed in a narrow space between the tile roof and the ceiling. In southern Texas the animals live on the brush-grown plains under conditions very different from those usually chosen.

Like its relative the raccoon, the cacomixtle, with a taste for a varied fare, takes whatever edibles come its way. It stalks wood rats, mice, and even bats amid their rocky haunts, and birds in bushes and low trees. About the southern end of the Mexican table-land it is much disliked for its robberies of chicken roosts, especially when these are located in trees. Insects of many kinds, larvæ, and centipedes are eaten, as well as a great variety of fruits, including that of the pear-leaved cactus, and dates, figs, and green corn.

Ring-tailed cats regularly locate among rocky ledges, neighboring orchards, or other cultivated areas where they may gather some of the bounty provided by man. I found them more plentiful among the broken lava cliffs bordering date-palm orchards in Lower California than in any other place. When the dates were ripening, they prowled about under the palms after dark with gray foxes and spotted skunks to pick up the fallen fruit. They sometimes uttered a complaining cry and when caught in a trap would bark almost like a little dog, or occasionally utter a vicious scream of mixed fear and rage.

Being an intelligent animal, the cacomixtle is readily tamed and makes a most interesting pet. During the early years of gold mining in California, when many men were living in rude cabins in the mountains, the prevalence of mice often attracted these "cats" to take up their residence there. Often the owner of the premises and the mouser struck up a friendly relationship and the cacomixtle, becoming as free and friendly about the place as a real cat, kept it entirely clear from mice. I have had first-hand accounts of these tame individuals from miners who had harbored them in this way for months. These accounts always gave the impression that the animal was somewhat playful and mischievous and most attractive to have about the premises. All agreed that they were extremely fond of sugar.

MARTEN, OR AMERICAN SABLE:
Martes americana and its relatives

(For illustration, see Color Plate, page 47)

Wild animals possess an endless variety of mental traits which endow them in many instances with marked individualities. Few are more strongly characterized in this respect than the marten. One of the most graceful and beautiful of our forest animals, it frequents the more inaccessible parts of the wilderness and retires shyly before the inroads of the settler's ax. Its rich brown coat, so highly prized that the pursuit of it goes on winter after winter in all the remote forests of the North, is a source of danger threatening the existence of the species. The full-grown animal weighs five or six pounds and measures nearly three feet in length.

The martens are circumpolar in distribution, and the several species occupy northern lands from England, Europe, and northern Asia to North America. Of the Old World species, the Siberian sable is best known on account of the beauty of its fine, rich fur, which renders it the most valued of all in the fur markets of the world.

The North American marten is a close relative of the Siberian species, and occupies all the wooded parts of North America from the northern limit of trees southward in the forested mountains to Pennsylvania, New Mexico, and the southern part of the Sierra Nevada in California.

Like other members of the weasel tribe, the marten is a fierce and merciless creature of rapine, but, unlike the mink and weasel, it avoids the abodes of man and loves the remotest depths of the wilderness.

Martens are endowed with an exceedingly nervous and excitable temperament, combined with all the flashing quickness of weasels. They are more restless than any other members belonging to the larger species of their notably restless tribe, and couple with this characteristic an extraordinary and tireless vigor. This is admirably shown in captivity, when they dart back and forth, up and down and around their cages by the hour with almost incredible speed.

In the forest they climb trees and jump from branch to branch with all the agility of a squirrel—in fact, they pursue and capture red squirrels in fair chase, and have been seen in pursuit of the big California gray squirrel (*Sciurus griseus*). On the ground they move about quickly, hunting in weasel fashion, under brush piles and other cover.

Practically every living thing within their power falls victim to their rapacity. They eat minks, weasels, squirrels, chipmunks, wood rats, mice of many kinds, conies, snowshoe hares, ruffed and spruce grouse, and smaller birds of all kinds and their eggs, as well as frogs, fish, beetles, crickets, beechnuts, and a variety of small wild fruits. Unlike minks and weasels, they are not known to kill wantonly more than they need for food.

They make nests of grass, moss, and leaves in hollow trees, under logs, among rocks, and in holes in the ground. Sometimes they have been found in possession of a red squirrel's nest, probably after having slain and devoured the owner.

The young, varying from one to eight in number, are born in March or April. At first they are naked and helpless, but when large enough they accompany the mother on her search for food. This period of schooling lasts until they are forced to take up their separate lives with the approach of winter. Thenceforth they are among the most solitary of animals, showing fierce antagonism toward one another whenever they meet, and associating only during a brief period in the mating season in July and August. It appears to have been definitely established through observations on animals in captivity that the young of the American marten are born about eight months after the mating time. Martens show a cold-blooded ferocity toward one another that often renders it dangerous to put two or more in the same cage. When placed in a cage together, the male very commonly kills the female by biting her through the skull. At times they utter a loud, shrill squall or shriek, and in traps hiss, growl, and sometimes bark.

Among the dense forests of spruce and lodgepole pine high up in the mountains of Colorado, martens are sometimes hunted on skis in midwinter, an exciting and often, on these rugged slopes, a dangerous sport. They are not wary about traps and are readily caught by deadfalls and other rude contrivances as well as by steel traps. In Colorado and Montana hundreds of their skins are taken by trappers every winter.

In Siberia the sable has been exterminated by hunting in many districts, and before the World War began it had become so scarce in others that the Russian Government closed the season for them for a period of years over nearly all of their range. The same reduction in the numbers of our marten has occurred in most parts of Alaska and elsewhere in its range, and its only hope against extermination lies in stringent protection. Protective regulations are already in force in Alaska.

During the early fur-trading days in northern Canada the number of martens varied between comparative abundance and rarity. These variations were said to occur about every ten years. Some claimed the decrease was due to a migration which the martens were believed to make from one region to another, just as was believed of the lynx. The lack of a corresponding increase in surrounding districts, where trading posts were located, effectually disproved the migration theory. There is little doubt that the increase of martens was due to a reproductive response to a plentiful food supply during years when mice or snowshoe hares were abundant, and that their decrease was due to a lessening of the numbers of these food animals.

Efforts are being made to domesticate martens and raise them for their skins on fur farms. The main difficulty so far encountered lies in the fiendish manner in which the old males kill the females and the younger males and in the difficulty of getting them to breed freely. Although always nervous, they are not difficult to tame, and will be most entertaining and attractive animals to rear if their savage natures can be sufficiently overcome.

FISHER, OR PEKAN: Martes pennanti

(For illustration, see Color Plate, page 47)

The fisher is one of the largest and handsomest members of the weasel family. Like others of this group, it is a long-bodied, short-legged animal. It attains an extreme length of from 3 to 3½ feet and a weight of 18 or 20 pounds, but the average is decidedly lower than these figures. In general, it is like a gigantic marten, and from its size and dark color is sometimes known locally as the "black cat" or "black fox."

It lives in the forested parts of Canada and the United States, where it originally occurred from the southern shores of Hudson Bay and Great Slave Lake south throughout most of eastern Canada and New England and along the Alleghenies to Tennessee; also in the Great Lakes region, south to the southern end of Lake Michigan; along the Rocky Mountains to Wyoming, down the Cascades to northern California, and from the Atlantic coast of Nova Scotia and Maine to the Pacific coast of southeastern Alaska and British Columbia. They still occur regularly in the Adirondacks of New York, the Green Mountains of Vermont, and in Maine, but are gone from most of the southern border of their former range.

Fishers are powerful and agile animals, probably for their size by far the swiftest and most deadly of all our forest carnivores. So swift and dextrous are they in the tree tops that they not only capture squirrels without difficulty, but are able to overtake and kill the marten, almost an incredible feat. When in pursuit of their prey or when alarmed, they make astonishing leaps from tree to tree. While not so speedy on the ground as some other animals, they have the tireless persistence of their kind and capture snowshoe hares in fair chase.

Among the inhabitants of the forest, the fisher is a fearless and savage marauder, which feeds on frogs, fish, and nearly every bird and mammal its domain affords, except species so large that their size protects them. Porcupines are among its favorite victims and are killed by being turned over and attacked on their underparts. As a result of such captures, the fisher often has many quills imbedded in its head and the foreparts of its body.

The fisher, like many other predatory animals, has more or less regular "beats" along which it makes its rounds over the territory it occupies. These rounds commonly require several days to accomplish. In winter it keeps mainly along wooded ridges, where it is trapped.

It follows trap lines like the wolverine and eats the bait or the captured animal, but, unlike the wolverine, appears to have no propensity for further mischief. When overtaken by dogs or when at war with any of its forest rivals, it is so active and ferocious that it is worthy all due respect from antagonists several times its size.

Although essentially a tree animal, much of the fisher's time is spent on the ground. In summer it appears to be fond of heavy forests in low-lying situations and the vicinity of water. Its dens are usually located in a hollow high up in a large tree, but sometimes in the shelter of fallen tree trunks or crevices in the rocks, where, the last of April or early in May, the young are born. These may number from one to five, but are usually two or three. The young begin to follow the mother in her wanderings when quite small and do not leave her guardianship until nearly grown.

The fisher is not a common animal and only about 8,000 of its skins are marketed each year.

Owing to its size, it is conspicuous, and its very fearlessness tends to jeopardize its existence. It is gone from most of the southern part of its former range and will no doubt continue steadily to lose ground with the increasing occupation of its haunts.

LEAST WEASEL: **Mustela rixosa** and its relatives

(*For illustration, see Color Plate, page* 65)

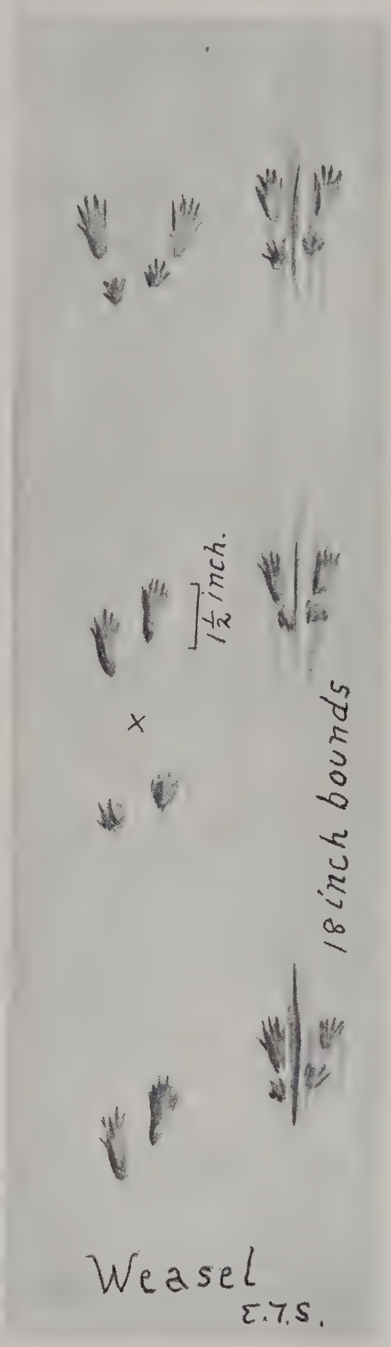
In addition to the larger members of the tribe briefly described in the following sketch, the true weasels include another group of species, so small that they may appropriately be termed the dwarfs of their kind. They vary from a half to less than a fourth the size of the larger weasels, but have the same characteristic form and proportions, except that the tail is very short and never tipped with black. Like the larger species, when snow occurs they change their brown summer coat for white at the beginning of winter and back again in spring.

The least weasels are also circumpolar in distribution, but are limited to the northern parts of Europe, Asia, and North America. In England and other parts of the Old World the group is represented by the well-known species *Mustela vulgaris.* In North America several species are known which, between them, share all the continent from the Arctic coast south to Nebraska and Pennsylvania. On the desolate islands extending from the mainland far toward the Pole, their place seems to be taken by the ermine.

The dwarf weasels appear to be less numerous and, as a consequence, less known in most parts of America than in England and northern Europe. Our most northern species, *Mustela rixosa,* sometimes called the "mouse weasel," occupies Alaska and northern Canada and has the distinction of being the smallest known species of carnivore in the world. In this connection it is interesting to note that in Alaska we have associated on the same ground the least weasel and the great brown bear, the smallest and the largest living carnivores.

Least weasels are characterized by the same swift alertness and boldness so marked in the larger species. In fact they are, if possible, even quicker in their movements. Once when camping in spring among scattered snowbanks on the coast of Bering Sea, I had an excellent opportunity to witness their almost incredible quickness. Early in the morning one suddenly appeared on the margin of a snowbank within a few feet. After craning its neck one way and the other, as though to get a better view of me, it vanished, only to reappear so abruptly on a snowbank three or four yards away that it was almost impossible to follow it with the eye. It was beginning to take on its summer coat of brown and was extremely difficult to locate amid the scattered patches of snow and bare moss of the tundra. Certainly no other mammal can have such flashlike powers of movement.

They feed mainly on mice, lemmings, shrews, small birds, their eggs and young, and insects. Mice furnish a large proportion of their prey



THE TRACK OF THE WEASEL

The unusual space between the fore and hind feet in the middle of the left series is often seen. Sometimes the tail mark is there and sometimes not. Occasionally the trail is like that of a small mink (see pages 67 and 69). The toes seldom show. The nervous energy of these animals seems indicated by their tracks.

and weasels have often been seen following the runways of field mice. Their small size enables them to pursue mice into their underground workings as readily as a ferret enters a rabbit burrow. They also climb trees and bushes with great agility, although nearly always seeking their victims on the ground. The mice are often so much the larger animals that they cannot be dragged into their captors' dens. The weasels continue in full activity throughout the winter and constantly burrow into the snow in search of their prey. In the snow or in the ground the holes of this animal are about the diameter of one's finger.

In the Old World the small weasels are reported to have several litters in a season, each containing five or six young. At Point Barrow, Alaska, a female captured on June 12 still contained twelve embryos. This indicates that only one litter a year would be born there, and that *Mustela rixosa* is more prolific than its European representative.

In the more southern latitudes, least weasels live in forests and about farms, sheltering themselves under logs, brush piles, stone walls, and similar cover. They are always restless and filled with curiosity regarding anything of unusual appearance. When one encounters a man it shows no fear, but, shyly moving from one shelter to another, now advancing and now retreating, examines the stranger carefully before going on its way. As they devote practically their entire lives to the destruction of field mice, they are valuable friends of the farmer and should have his good will and protection. Unfortunately for these weasels, no discrimination is shown between them and their larger relatives of more injurious habits.

Among the natives of Alaska all weasels are looked upon with great respect on account of their prowess as hunters. I found this feeling peculiarly strong among the Eskimos, whose existence for ages has depended so largely on the products of the chase. Among them the capture of a weasel meant good luck to the hunter, and to take the rarer least weasel was considered a happy omen. The head and entire skin of the least weasel were highly prized for wearing as an amulet or fetish. Young men eagerly purchased them, paying the full value of a prime marten skin, to wear as a personal adornment so that they might thus become endowed with the hunting prowess of this fierce little carnivore. Fathers often bought them to attach to the belts of their small sons, so that the youthful hunters might become imbued with the spirit of this "little chief" among mammals.

LARGE WEASEL, OR STOAT: Mustela arctica and its relatives

(*For illustration, see Color Plate, page* 65)

The large weasels may be distinguished from the larger members of the genus by the small size and the snakelike proportions of the flattened and pointed head, combined with a long, extremely slender neck and body and a comparatively long tail. The best known of these animals are the stoat of the northern parts of the Old World (*Mustela erminea*) and its close relative in northern North America (*Mustela arctica*), the winter skins of which furnish the famed ermine, once sacred to the trappings of royalty.

All Northern weasels are strongly marked by their habit of changing their brown coat to one of snowy white at the beginning of winter. To the south the change becomes less complete as the winter snows decrease, and south of the limit of snow the brown coat is retained throughout the year. The time of change depends on the coming of the snow and varies with the year, and the time of resumption of the brown coat in spring depends in the same way on the season. The white winter coat of the larger and medium-sized species is varied by a strongly contrasting jet-black tip to the tail.

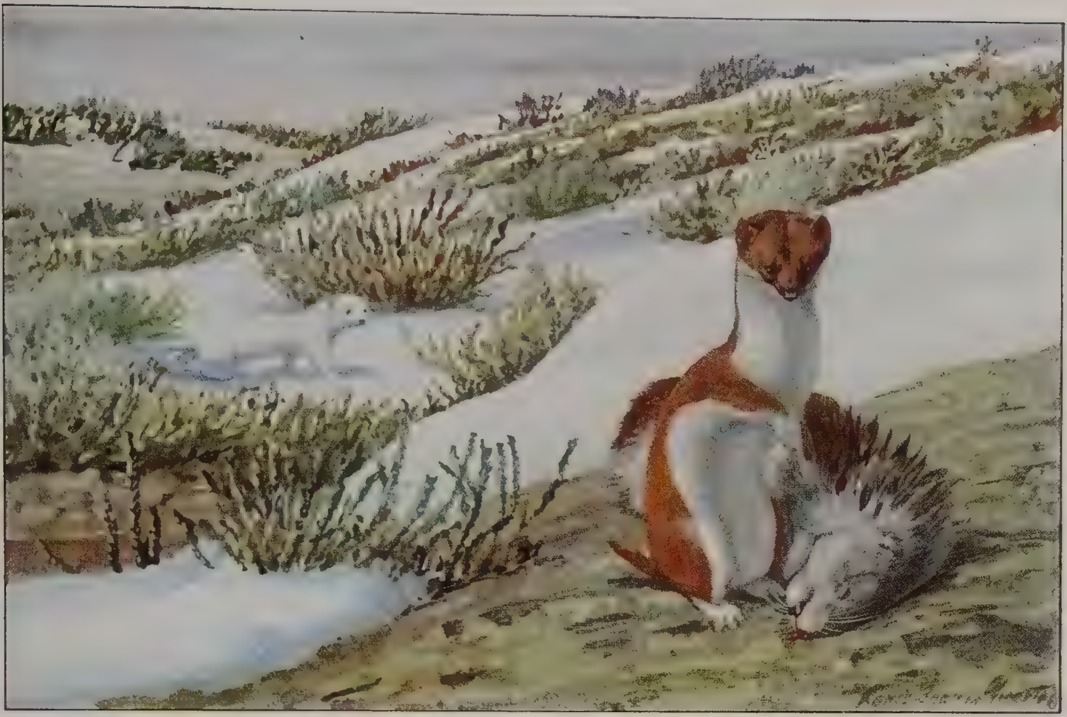
Weasels are circumpolar in distribution and occupy nearly all parts of Europe, Asia, and North and South America, the greatest number and variety of species perhaps occurring in North America. Surprisingly enough, the largest of these eminently northern animals is found in the forests of the American Tropics. The Arctic weasel ranges to the northernmost Polar lands of North America, where its presence has been recorded many times by icebound explorers. Other species are more or less generally distributed over the remainder of the continent. In Mexico I have found them from sea level to above timberline, at more than 13,000 feet altitude on the high volcanoes.

The strong personality of the weasels as a group is based mainly on their extraordinary celerity of movement, their courage, and their insatiable desire to kill. They are not satisfied with supplying the call for food, but whenever opportunity arises kill from sheer lust of slaughter.

Their slender forms enable them to follow their prey to the remotest depths of their retreats, and that all rodents have an abiding horror of them is shown by the effect of a weasel's appearance. Rabbits, although many times their size, become easy victims, and in one instance when a large rat, which had fought its human captor viciously, was put in a cage with a weasel, it at once lost all its courage and permitted itself to be killed without an effort at defense.

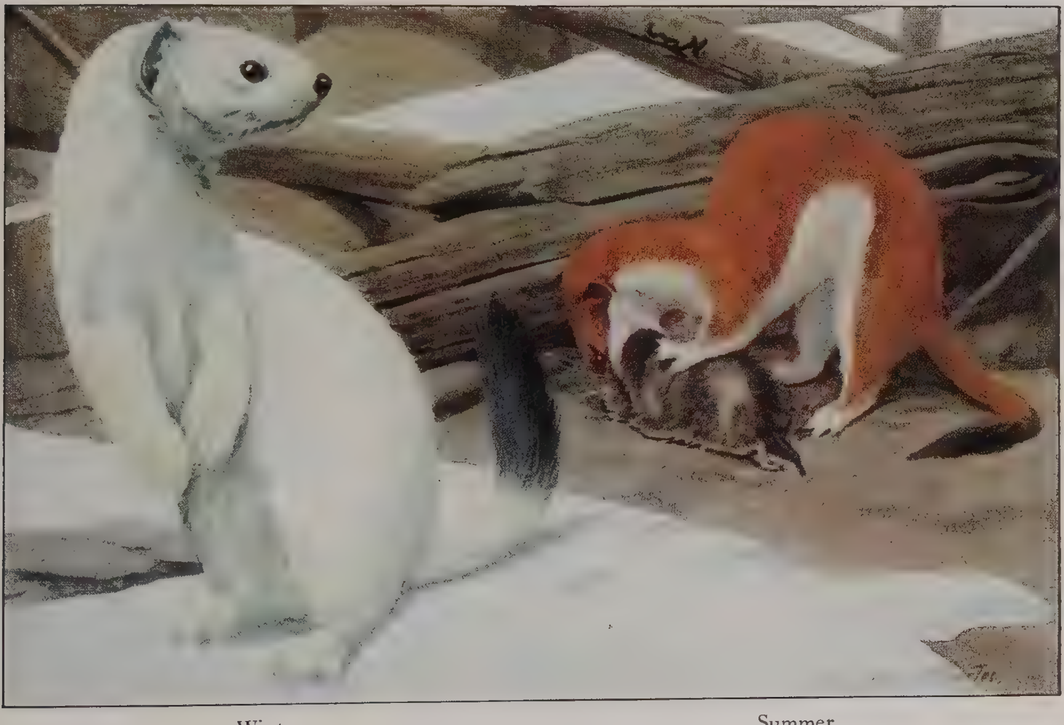
Weasels are wonderfully endowed for their predatory work and are undoubtedly the most perfectly organized machines for killing that have been developed among mammals. Their keen eyes are constantly alert to observe everything about them, their ears are attuned to catch the faintest squeak of a mouse or cry of any other small animal, and their powers of scent are very great. When hunting they dart in and out of the holes of rodents, among crevices in the rocks, or through brush piles, pausing now and then to stand upright on their hind feet, the head swaying to and fro as they peer about. The squeak of a mouse starts them instantly in search of it, and like a dog they trail rabbits and other rodents by scent.

As a rule, weasels are terrestrial, but in wooded country they climb trees and leap from branch to branch with all the ease of squirrels. In most localities they are not common, but



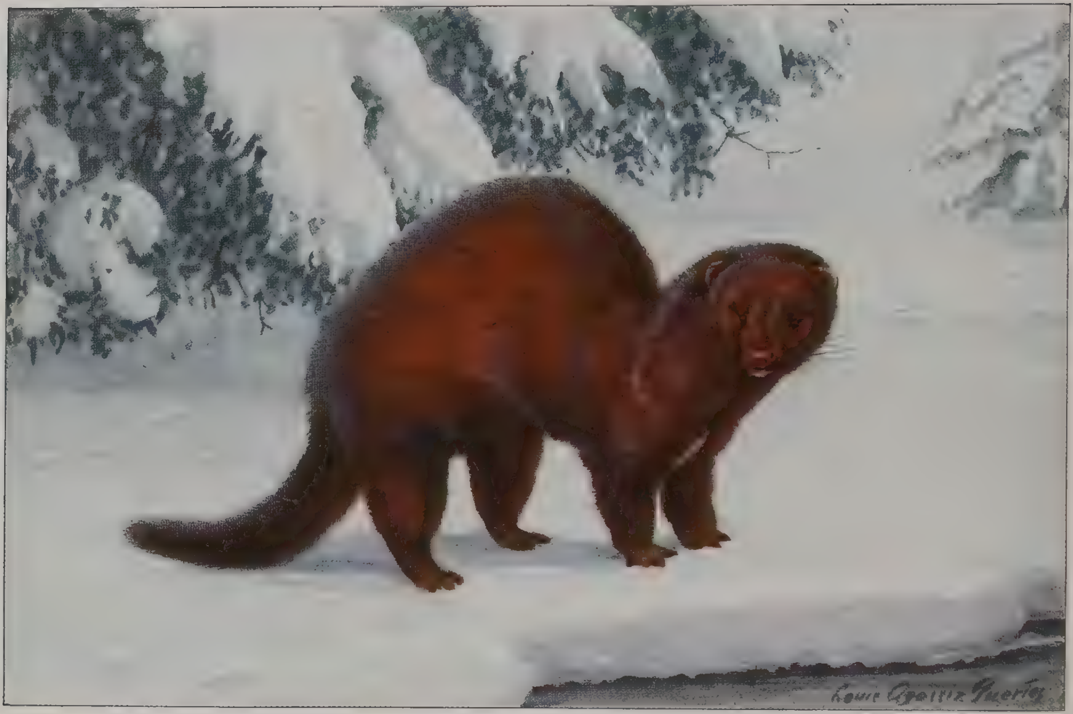
Winter Summer

LEAST WEASEL
Mustela rixosa

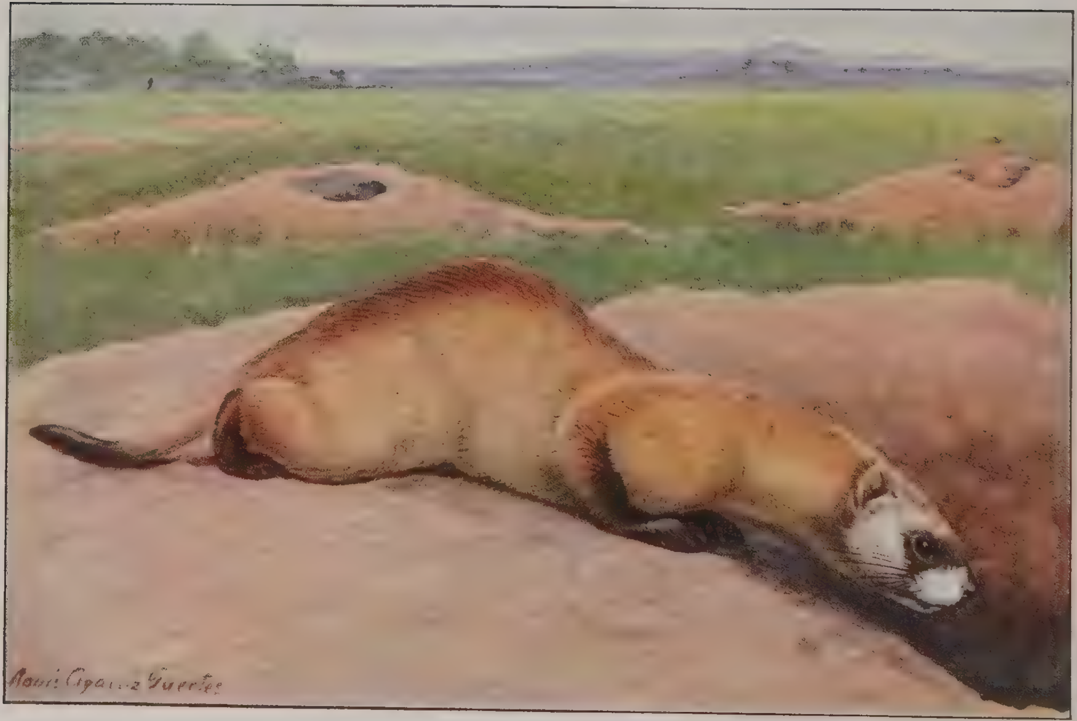


Winter Summer

LARGE WEASEL, or STOAT
Mustela arctica



AMERICAN MINK
Mustela vison



BLACK-FOOTED FERRET
Mustela nigripes

now and then, where conditions are peculiarly favorable, they become nuerous. At one naturalist's camp in the upper Yukon they were surprisingly abundant, so much so that more than forty were caught in a few days in traps set among broken rocks. There they were extremely bold, hunting for their prey among the rocks within a few feet of the trappers.

The prey of weasels includes almost every kind of small rodent and bird living within their territory. They feed especially upon northern hares, cottontails, conies, ground squirrels, chipmunks, tree squirrels, wood rats, mice, lemmings, quail, ptarmigan, spruce and ruffed grouse, ducks, and numberless other small species. They are also very destructive to domestic fowl, often killing thirty or forty in a night. They unhesitatingly attack rodents many times their own weight.

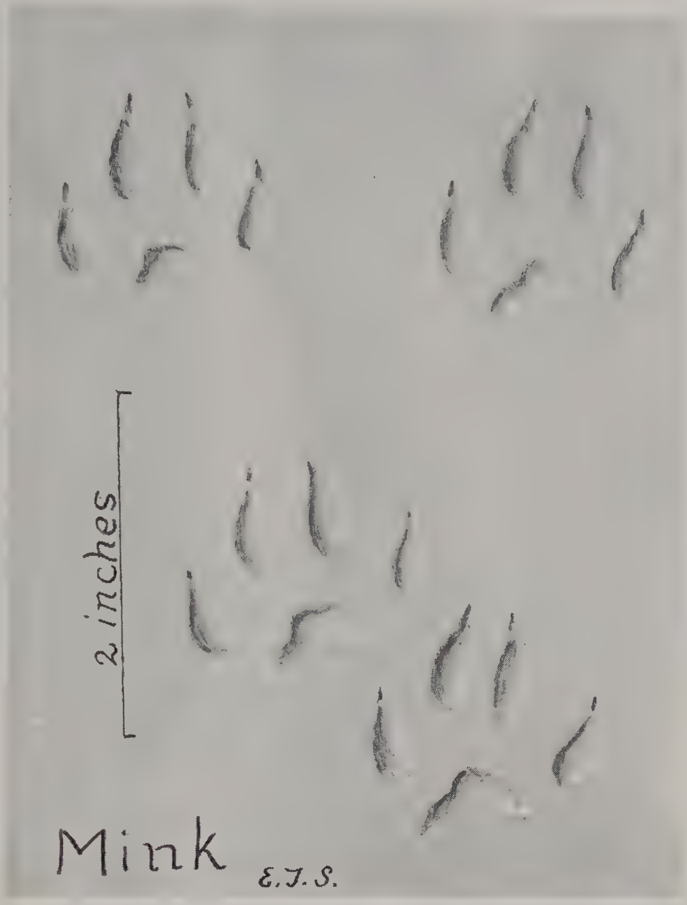
Once when hunting on the open plain near the southern end of the Mexican table-land, I saw at some distance what appeared to be a brown ball rolling about on the ground. This was soon determined to be a weasel fastened to one of the large and powerful pocket gophers of that region. The weasel had its teeth set in the back of the neck of the gopher, while the latter was blindly trying to tear itself loose. I fired an ineffectual shot at the weasel and it vanished like a flash in the open tunnel of the gopher. As I drew near, the gopher, still in fighting mood, faced me with bared teeth. Later, when I removed its skin, I found that the weasel had torn loose the attachment of the heavy neck muscles to the back of the skull until only a thin layer remained to protect the spinal column. This had been accomplished without breaking the thin, but extremely tough, skin of the gopher.

When a weasel is attacking an animal which resists, like a large ground squirrel, it raises its head and sways its long neck back and forth, its eyes glittering with excitement as it watches for an opening to spring forward and seize its prey. Its attack is always aimed at a vital point, commonly the brain, the back of the neck, or the jugular vein on the side.

Weasels dig their own burrows under the shelter of slide rock, ledges, stone walls, stumps, and outbuildings, or they occupy hollow trees and the deserted burrows of other animals. In nests thus safely located they have one litter containing an average of from four to six, but sometimes numbering up to twelve, young a year, born at any time from April to June, according to the latitude. The number of young in a litter is enough to render weasels very abundant, but this is rarely the case, and raises the question as to the influence which holds their number in check.

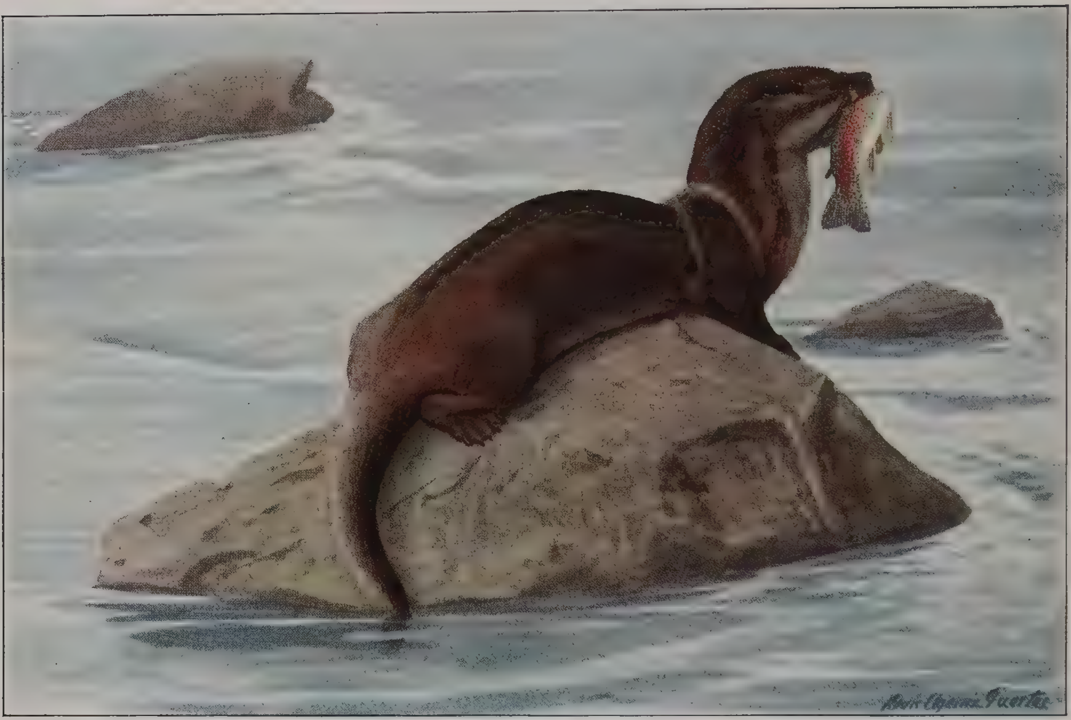
They are both nocturnal and diurnal, apparently in almost equal degree, since they are frequently observed hunting in the middle of the day, while their nocturnal raids on poultry houses testify to their activities at night. When hunting they appear like sinister shadows and are persistent in pursuit.

The young commonly remain with the female until nearly or quite grown and follow her closely on hunting trips. It is interesting to see a pack of these deadly carnivores working,

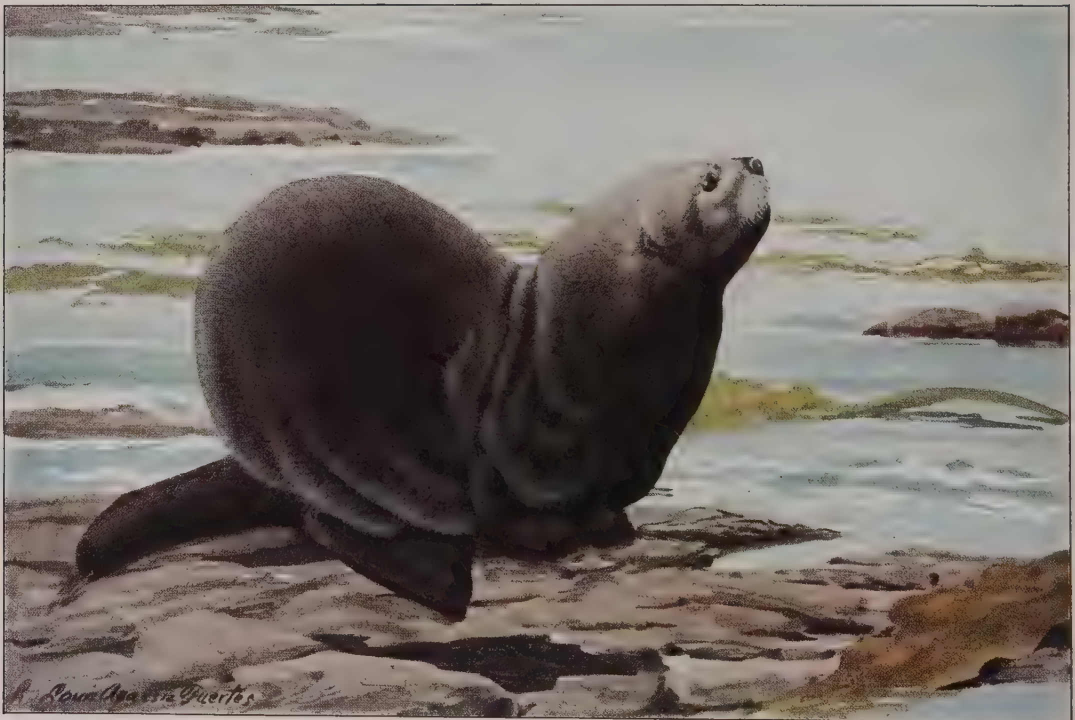


AMERICAN MINK TRACK, NEARLY NATURAL SIZE

Although this animal has five toes on each foot, only four appear in each track. This illustration shows the usual arrangement of the track. The hindfeet are, of course, in advance. Variations of arrangement are shown in the illustration on page 69.

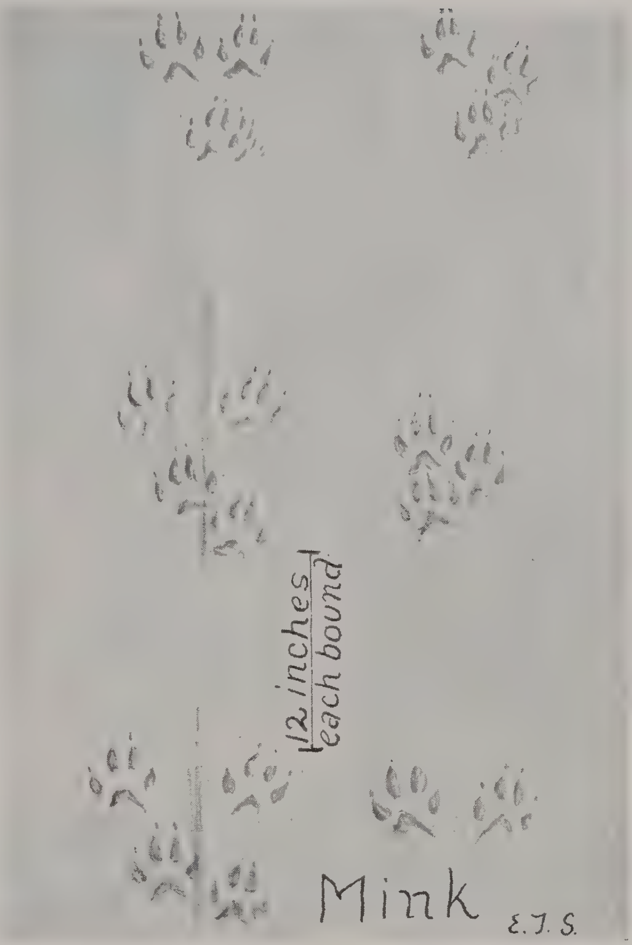


CANADIAN OTTER
Lutra canadensis



SEA OTTER
Enhydra lutris

the mother leading and the young skirmishing on all sides, now spreading out, now closing in, like a pack of miniature hounds. On these family hunting parties, however, they usually keep close to rocks, logs, brush, or other cover.



AMERICAN MINK TRACKS, SHOWING VARIOUS ARRANGEMENTS AND TAIL MARKS

The typical track of a mink is shown in the bottom set at the left, which also illustrates the tail mark. Twelve to twenty-four inches are usually cleared at each bound. This illustration is greatly reduced from natural size.

Themselves subject to the law of fang and claw, weasels are killed and eaten by wolves, coyotes, foxes, and various birds of prey. Their very lack of fear perhaps in many cases leads to their destruction.

These representatives of the primitive woodland life continue to occupy practically all of their original range. They visit farms in all parts of the country and I have seen them near the outskirts of Washington, D. C.

It is well that weasels are not abundant, for beasts with such innate ferocity and love of killing would otherwise be a menace to the existence of many useful species of birds and mammals, especially the game birds. In many places they live almost entirely on mice, and there they should be left unmolested; but whenever they locate in the vicinity of a chicken yard the owner will do well to take proper measures for protection.

AMERICAN MINK: **Mustela vison** and its relatives

(*For illustration, see Color Plate, page* 66)

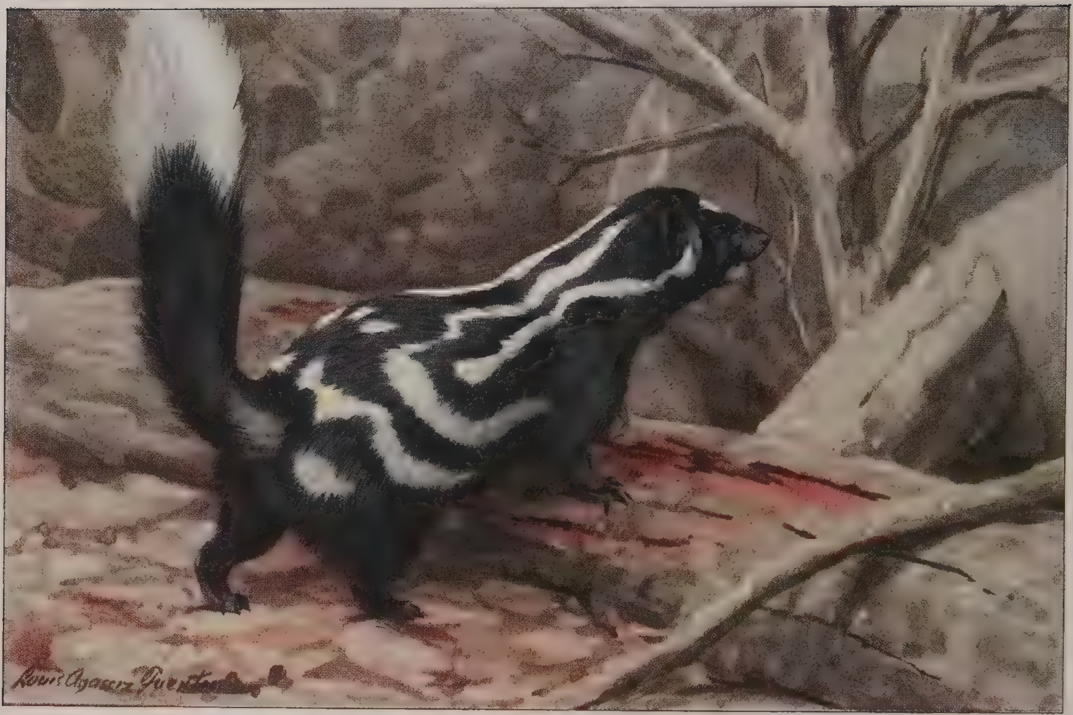
In the American mink we have one of the most widely known and valuable fur bearers of the weasel family. It is a long-bodied animal, but more heavily proportioned than the weasel, and attains a weight of from one and one-half to more than two pounds. It has short legs and walks slowly and rather clumsily with the back arched. When desiring to travel fast it moves in a series of rapid, easy bounds which it appears able to continue tirelessly.

The minks form a small group of species circumpolar in distribution, and well known in Europe, northern Asia, and in North America. The European animal is closely similar to the North American species and all have the same amphibious habits. The American minks include several different geographic races, which are distributed over all the northern part of the continent from the Atlantic to the Pacific and from the mouths of the Yukon and Mackenzie Rivers to the Gulf coast in the United States. They are absent from the arid Southwestern States.

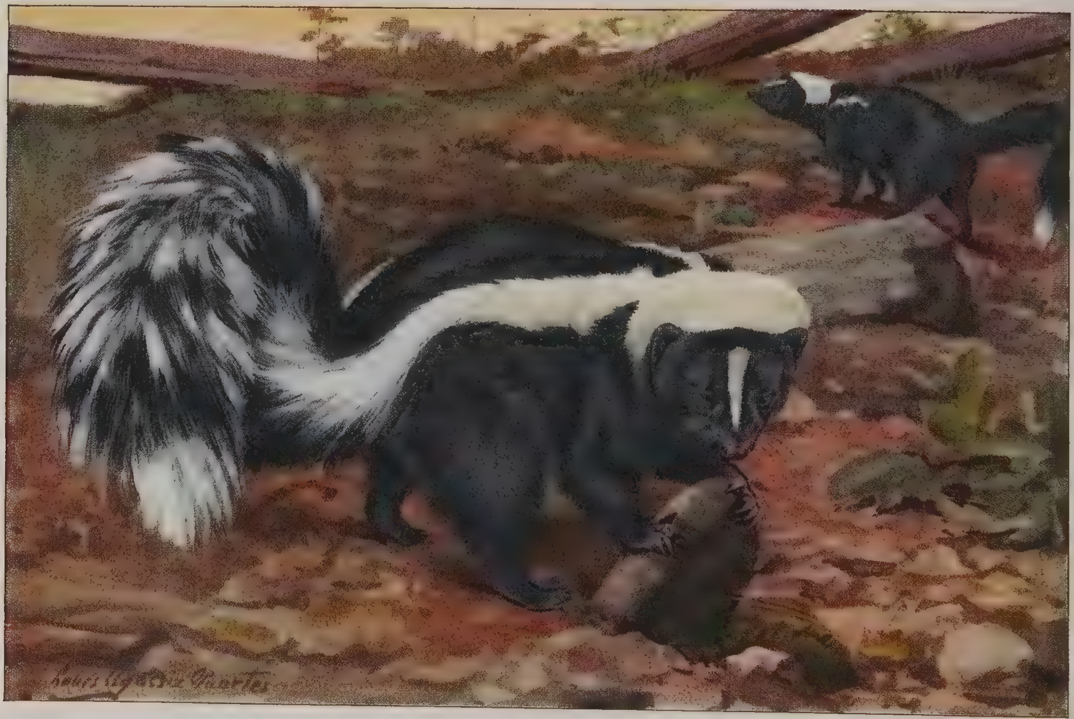
Few species are more perfectly adapted to a double mode of life than the mink. It is equally at home slyly searching thickets and bottom-land forests for prey or seeking it with otter-like prowess beneath the water. It is a restless animal, active both by day and by night, although mainly nocturnal.

While usually having definite dens to which they return, minks wander widely and for so small an animal hunt over a large territory and pass from one body of water to another. Their wanderings are most pronounced in fall and again during the mating in spring. They are solitary, their companionship with one another not outliving the mating period.

Mink dens are located wherever a safe and convenient shelter is available, and may be a hole in a bank, made by a muskrat or other animal, a cavity under the roots of a tree, a hollow log, a hollow stump, or other place. The nest is made of grass and leaves lined


Louis Agassiz Fuertes

LITTLE SPOTTED SKUNK
Spilogale putorius


Louis Agassiz Fuertes

COMMON SKUNK
Mephitis mephitis

with feathers, hair, and other soft material. A single litter of from four to twelve small and naked young is born during April or May.

The young remain with the mother throughout the summer, and do not leave her to establish themselves until fall, when they are nearly grown. When captured at an early age they are playful and become attached to the person who cares for them. When caught in a trap they become fiercely aggressive, often uttering squalling shrieks, baring their teeth, and fronting their captor with a truculent air of savage rage. The adults have scent sacs located under the tail like those of a skunk. When angry or much excited they can emit from these an exceedingly acrid and offensive odor, but have no power to eject it forcibly at an enemy.

Minks are bold and courageous in their attitude toward other animals, and attack and kill for food species heavier than themselves, like the varying hare and the muskrat. On land they are persistent hunters, trailing their prey skillfully by scent. They eat mice, rats, chipmunks, squirrels, and birds and birds' eggs of many kinds, including waterfowl, ovenbirds, and other ground-frequenting species. About the waterside they vary this diet by capturing fish of many kinds, which they pursue in the water, snakes, frogs, salamanders, insects, crustaceans, and mussels.

Their prowess is shown by their raids on chicken-houses, where they often kill many grown fowls in a night, and sometimes drag birds heavier than themselves long distances to their dens. A remarkable indication of the varied menu of the mink was exhibited in a nest found by Dr. C. H. Merriam, where the owner had gathered the bodies of a muskrat, a red squirrel, and a downy woodpecker.

The value of the mink's furry coat has led to its steady pursuit by trappers in all climes, from the coast of Florida to the borders of sluggish streams on Arctic tundras. Millions of them have fallen victims to this warfare and their skins have gone to adorn mankind. In spite of this, the mink to-day occupies all its original territory, and each year yields a fresh harvest of furs.

The mink by preference is a forest animal, living along the wooded bottom lands of rivers or the thicket-grown borders of small streams, where the rich vegetation gives abundance of shelter and at the same time attracts a wealth of small mammals and birds on which it may prey. From these secure coverts it wanders through the surrounding country at night, visiting many chicken-houses on farms and leaving devastation behind. It is persistent and bold in such forays and in locations near its haunts great care must be exercised to guard against it. Minks have repeatedly raided the enclosures of the National Zoölogical Park in Washington, D. C.

Now and then, on the banks of some wild stream, one will try to appropriate the catch lying at the very feet of a lone fisherman. A naturalist fishing on a stream in northern Canada, seeing a mink making free with his catch, set a small steel trap on the bare ground, and, holding the attached chain in one hand, raised and slowly drew toward him the fish upon which the mink was feeding. The mink, without hesitation, followed the fish and was caught in the trap.

An abundance of food may modify the preference of the mink for wooded or partly wooded country. The marshy and treeless tundra lying near sea level in the triangle between the coast of Bering Sea and the lower parts of the Yukon and Kuskokwim Rivers offers such an attractive situation differing from their usual haunts. The sluggish streams and numberless ponds abound with small fish four to five inches long. Minks swarm in this area to such an extent that the Eskimos who inhabit the district are known among the natives of the surrounding region as the "mink people." Steel traps are used there, but a primitive method is even more successful. A wicker fence is built across a narrow stream and a small fyke fish-trap placed in it. In swimming along the stream minks pass into the trap like fish, and I knew of from 10 to 15 being thus taken in one day.

During my residence in that region, from 10,000 to 15,000 mink skins were caught in this tundra district annually, and the supply appeared to be inexhaustible. With the growing occupation of the continent and the increasing demand for furs, however, the numbers of the mink must surely decrease. To forestall the shortage of furs that seems imminent, efforts are now being made to establish fur farming to replace the declining supply of wild furs with those grown under domestication. The mink appears to be well adapted to successful breeding in captivity. The main question to solve is the relation of the cost of caring for the animal to the value of its pelt in the market.

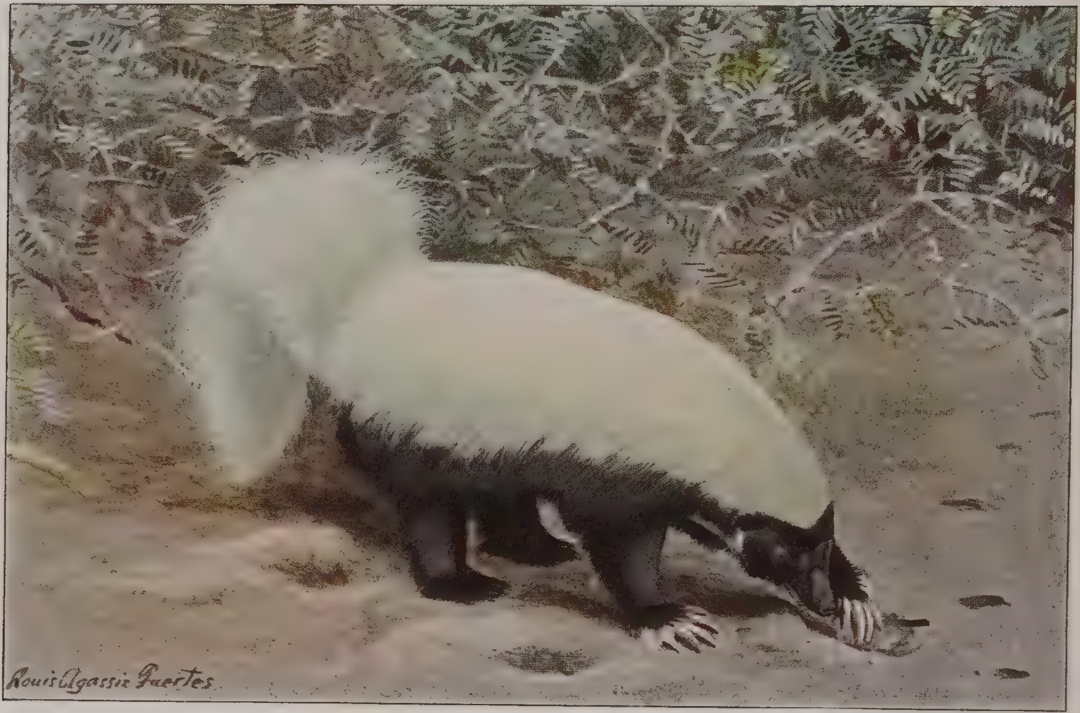
BLACK-FOOTED FERRET: Mustela nigripes and its relatives

(For illustration, see Color Plate, page 66)

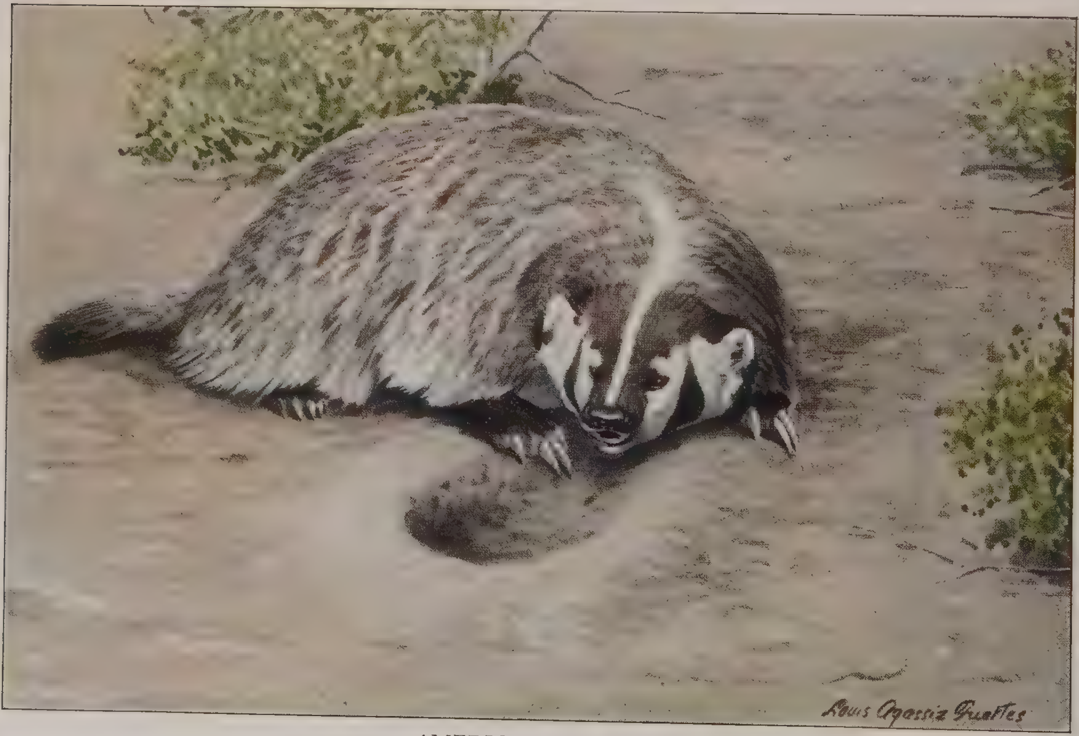
Of all the varied forms of mammalian life in America, the black-footed ferret has always impressed me as one of the strangest and most like a stranded exotic. It is about the size of a mink, but as the color plate shows, is entirely different in appearance and has the general form of a giant weasel. It has no close relative in America, but bears an extraordinarily close resemblance in size, form, and color to the Siberian ferret (*Mustela eversmanni*).

The black-footed ferret occurs only in the interior of the United States, closely restricted to the area inhabited by prairie-dogs, from the Rocky Mountains eastward and from Montana and the Dakotas to western Texas. It is known also west of the mountains in Colorado, New Mexico, and Arizona. Like others of the weasel tribe, it must have a wandering disposition, since one was captured at 9,800 feet altitude, and another was found drowned at 10,250 feet in Lake Moraine, Colorado.

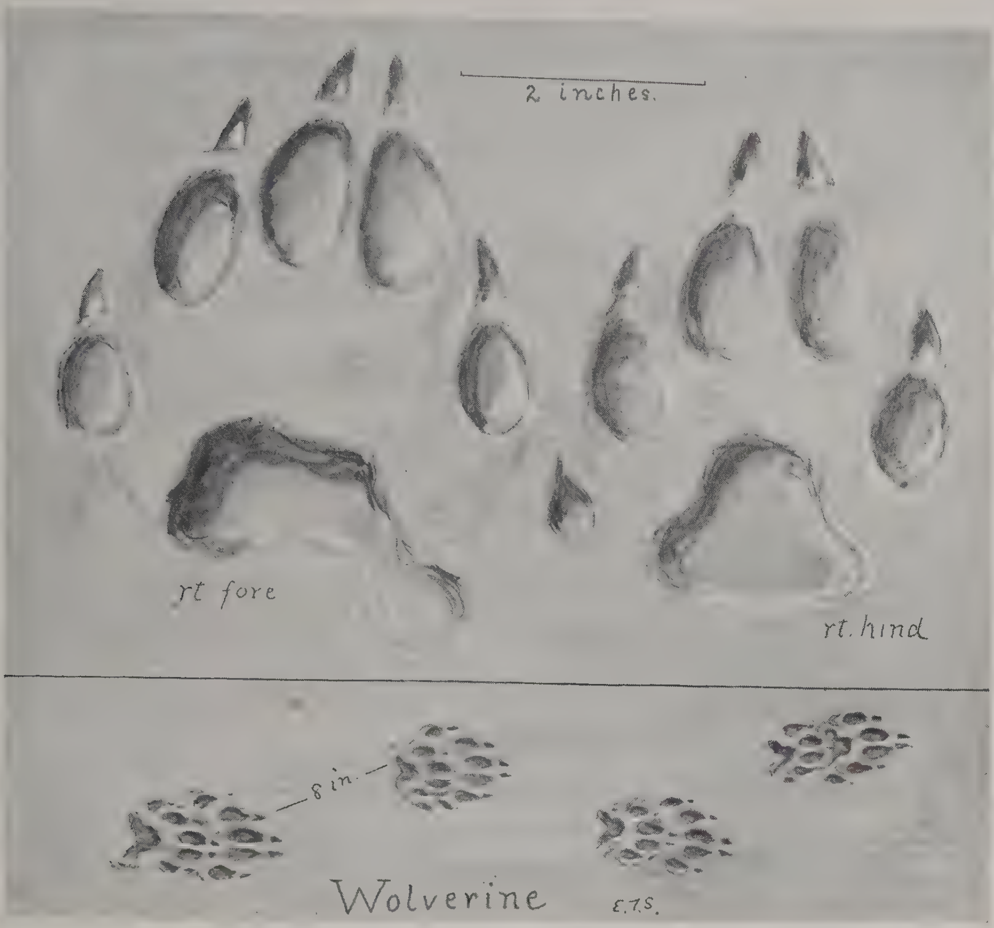
These ferrets exist as parasites in the prairie-dog colonies, making their homes in deserted burrows and feeding on the hapless colonists. In Kansas their presence in certain localities appears to have been effective in locally exterminating prairie-dogs, and similar activities may


Louis Agassiz Fuertes

HOG-NOSED SKUNK
Conepatus mesoleucus


Louis Agassiz Fuertes

AMERICAN BADGER
Taxidea taxus


2 inches.
rt fore
rt. hind
8 in.
Wolverine
E.T.S.

THE WOLVERINE TRACK SHOWS ITS WEASEL KINSHIP

Occasionally, not always, its fifth toe shows. The track is not plantigrade, and a single track is easily mistaken for that of a wolf.

account for the deserted "dog towns" which were not infrequently observed on the Plains with no apparent reason for the absence of the inhabitants.

They do not appear to be numerous in any part of their range and little is known concerning their habits. Now and then they are seen moving about prairie-dog towns, passing in and out of the burrows at all hours of the day, but it is probable that they are mainly nocturnal. This probability is strengthened by the extreme restlessness shown at night by captive animals. With the occupation of the country and the inevitable extinction of the prairie-dog over nearly or quite all of its range, the black-footed ferret is practically certain to disappear with its host species.

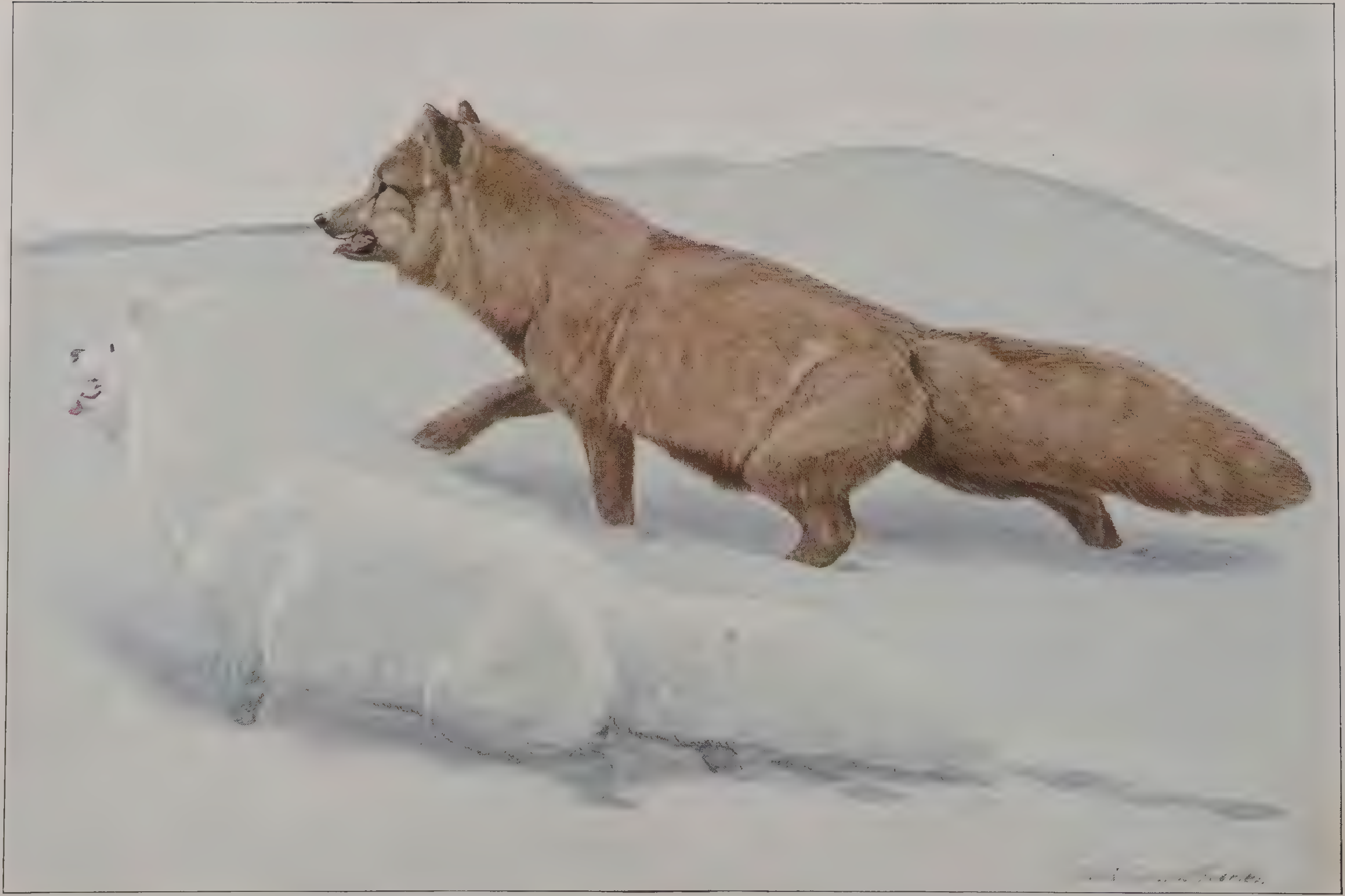
It has the same bold, inquisitive character shown by the weasel, and when its interest is excited will stand up on its hind legs and stretch its long neck to one side and another in an effort to satisfy its curiosity. When surprised in a dog town it commonly retreats to a burrow, but promptly turns and raises its head high out of the hole to observe the visitor. As a result ferrets are readily killed by hunters. When one is captured it will at first hiss and spit like a cat and fight viciously, but is not difficult to tame.

Although mainly dependent upon prairie-dogs for food, there is little doubt that ferrets, after the manner of their kind, also kill rabbits and other rodents in addition to taking whatever birds and birds' eggs may be secured. In one instance a black-footed ferret lived for several days under a wooden sidewalk in the border town of Hays, Kansas, where it killed the rats harboring there.

AMERICAN WOLVERINE: Gulo luscus

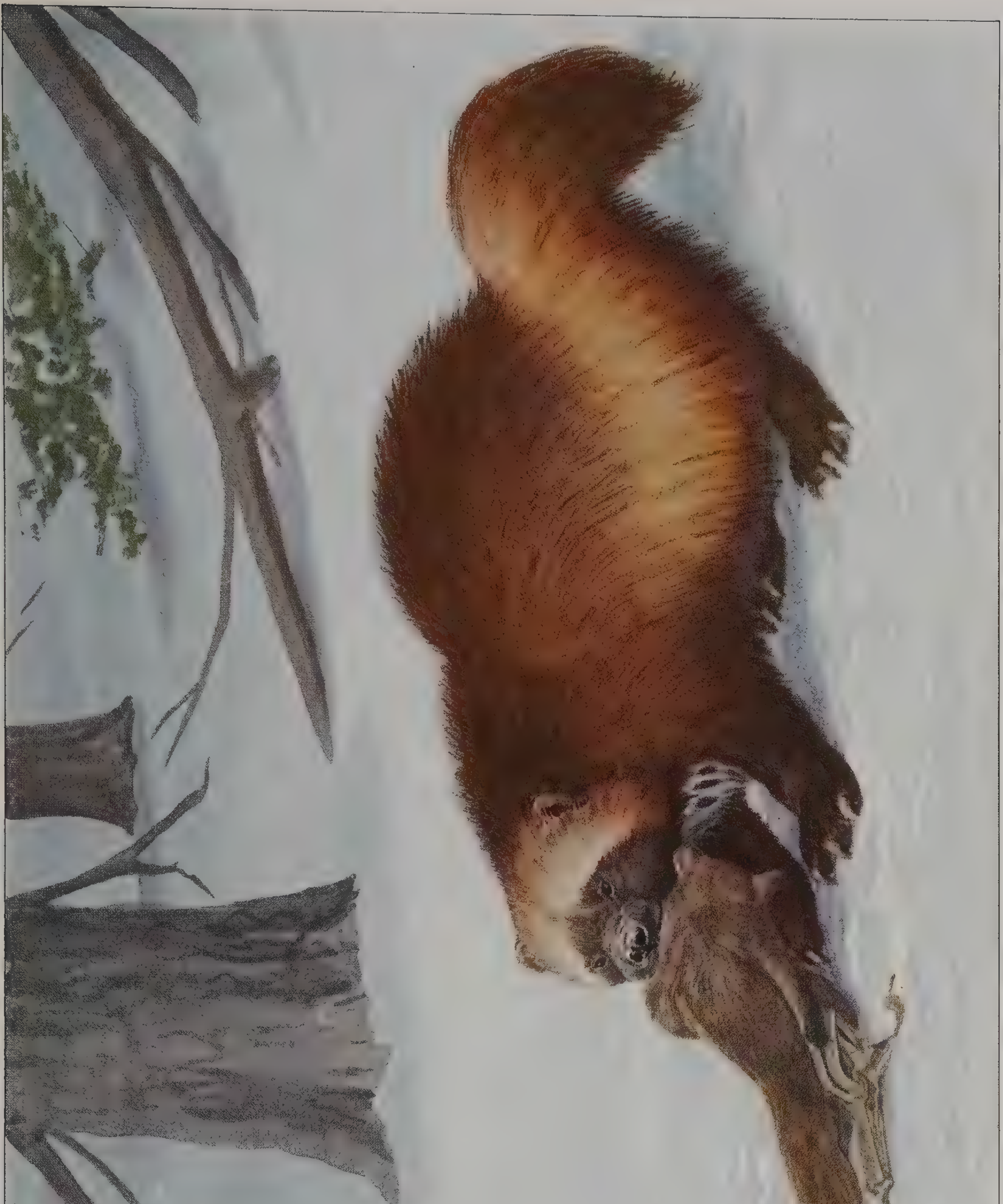
(For illustration, see Color Plate, page 75)

The wolverine, or carcajou of the Canadian voyageurs, is a circumpolar species belonging to the northern forested areas of both continents. In North America it formerly ranged from the northern limit of trees south to New



WHITE, or ARCTIC FOX
Alopex grœnlandicus

PRIBILOF BLUE FOX
Alopex pribilofensis



AMERICAN WOLVERINE
Gulo luscus

England and New York, and down the Rocky Mountains to Colorado, and down the Sierra Nevada to near Mount Whitney, California. A low, squat, heavy-bodied animal, with strong legs and feet armed with sharp claws, it is the largest and most formidable of the weasel family.

The wolverine is extraordinarily powerful and possesses what at times appears to be a diabolical cunning and persistence. It frequently trails trappers along their trap lines, eating or destroying their catches and at times hiding the traps. It is a tireless wanderer, and the hunter or traveler in the northern wilds always has this marauder in mind and is put to the limit of his wits to provide caches for provisions or other supplies which it cannot despoil.

What it can not eat it is likely to carry away and hide. A wolverine has often been known to expend a surprising amount of labor in apparently deliberate mischief, even carrying numerous articles away from camps and hiding them in different places. It sometimes trails a traveler for many miles through winter snow, always out of sight, but alert to take advantage of any carelessness in leaving game or other food unguarded.

Mingled with these mischievous traits the wolverine possesses a savage ferocity combined with a muscular power which renders it a dreaded foe of all but the largest animals of its domain. When guarding her young, the female is no mean foe, even for a man.

As a consequence of its mental and physical character, the wolverine, more than any other animal of the north, has impressed itself on the imagination of both native and white hunters and travelers. A vast amount of folklore has grown up about it and both Indians and Eskimos make offerings to propitiate its malignant spirit. The Alaskan Eskimos and the natives of northern Siberia trim the hoods of their fur garments with a strip of wolverine fur about their faces, as the smooth hairs of this animal retain less of the frozen moisture from the breath of the wearer than those of any other animal. Eskimo hunters wear belts and hunting bags made of the skin of the legs and head, that they may acquire some of the power of the animal from which these came.

The value of the handsome brown fur of the wolverine, as well as the enmity the animal earns among hunters and trappers, has resulted in its being so persistently hunted that it has become extinct over much of its former territory, and wherever it is still found it is much reduced in numbers.

CANADIAN OTTER: **Lutra canadensis** and its relatives

(*For illustration, see Color Plate, page* 68)

Land otters are common throughout a large part of the Old World, and when America was explored the animals were found generally distributed, and sometimes common, from the northern limit of trees in North America to southern South America. Within this great area a considerable number of species and geographic races of otters occur, all having a close general resemblance in appearance and habits.

The Canadian otter is the well-known type throughout the United States, Canada, and Alaska. It is a slender, dusky-brown animal from four to five feet in length, frequenting streams and lakes which contain a good supply of fish. Otters are too short-legged to move easily on land, but are remarkable for their admirable grace, agility, and swiftness in the water. Although so poorly adapted to land travel, they are restless animals, constantly moving up and down the streams in which they live and often crossing from one stream to another. In the Far North in midwinter they travel surprising distances across snow-clad country, following the banks of streams or passing between them searching for an entrance to water, whether through the ice or in open rapids.

In Alaska I saw many otter trails in the snow crossing the Yukon and through the adjacent forest. In such journeys it was evident that the animals progressed by a series of long bounds, each leaving a well-marked, full-length impression in the snow, so characteristic that it could not be mistaken. These trails, often leading for miles across country, always excited my deepest interest and wonder as to how the animals could succeed in finding holes through the ice in this vast snow-bound waste. Nevertheless they seemed to know full well, for the trails always appeared to be leading straight away for some known objective.

Although never very abundant, otters are so shy and solitary in their habits that they have managed to retain almost all of their original range. They occur now and then in the Potomac, near Washington, and in other rivers throughout the country, where their tracks may occasionally be detected on sand-bars and in the muddy shallows along the banks. A sight of the animals themselves is rare. Their dens are usually in the banks of streams or lakes above or below the surface of the water, under the roots of large trees, or beneath rocky ledges.

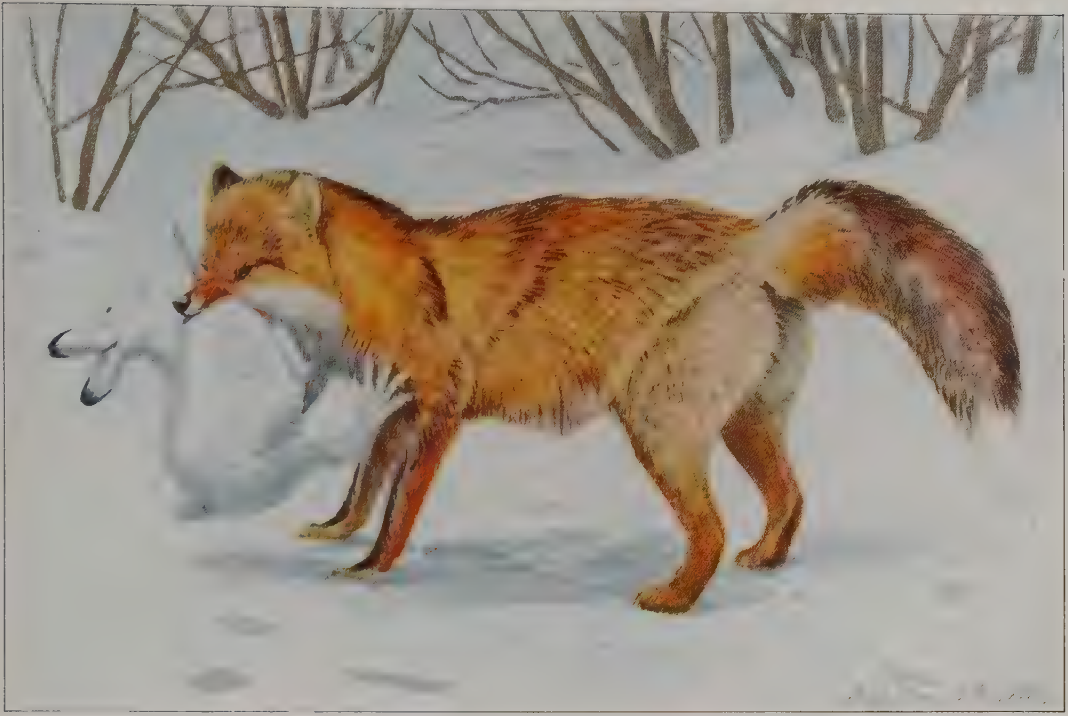
Otters are extremely playful and amuse themselves by sliding down steep banks into the water, repeatedly using the same place until a smooth chute or "slide" is defined. They usually have two to five young, which remain with the mother until nearly grown.

While close relatives of the weasel, they are much more intelligent, have a gentler disposition, and make playful and most interesting pets. Their fur is highly prized and always brings a good price in the market. As a result, they have been persistently hunted and trapped since our pioneer days. That the species should continue to exist, though in much diminished numbers, throughout most of its original range is a striking evidence of its retiring habits and mental acuteness.

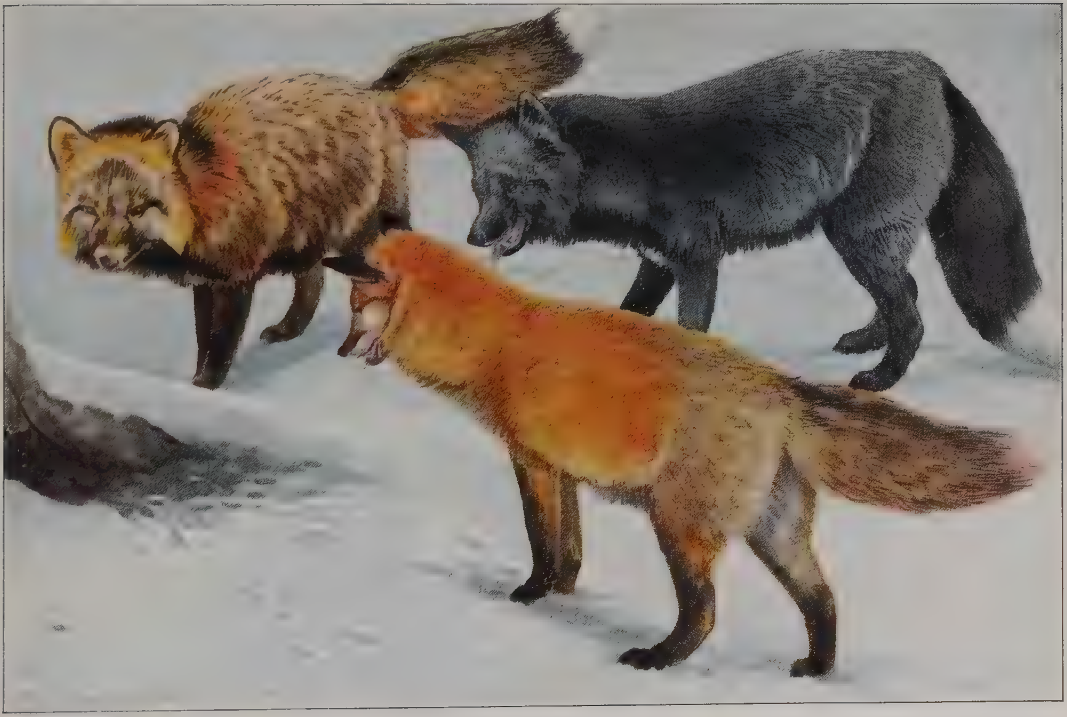
SEA OTTER: **Enhydra lutris** and its subspecies

(*For illustration, see Color Plate, page* 68)

Sea otters, distant relatives of land otters, are heavy-bodied animals, about four feet long, with broad webbed hindfeet. When in the water they have a general resemblance to seals, whose mode of life is similar to theirs. Their fur is



ALASKA RED FOX
Vulpes alascensis



CROSS FOX AMERICAN RED FOX SILVER FOX
Vulpes fulva

The precious black and silver-gray foxes and the cross fox are merely color phases occurring in litters of the ordinary red animal (see text, page 86) extremely dense and on the skins of adult males is almost black, closely sprinkled with long, white-tipped hairs. The fur of prime skins has a silky luster, equaled in beauty by only the finest silver-tipped fox skins. For centuries sea-otter fur has been highly prized and single skins have brought more than $2,000 in the London market.

Otters are limited to the coasts of the North Pacific where formerly they were incredibly abundant all the way from the shores and islands of Lower California to the Aleutians, and thence along the Asiatic coast to the Kuril Islands. Through excessive hunting, they are now extinct along most of this extended coastline.

In the days of the Russian occupation of Alaska the discovery of the abundance of sea otters led to intense activity in their pursuit. Otter-hunting expeditions were organized by the Russians along the storm-swept coast from Unalaska to Sitka, sailing vessels being used as convoys for hundreds of Aleut hunters in their skin-covered boats. The loss of life among the hunters under their brutal taskmasters was appalling and resulted in seriously and permanently reducing the native population of the Aleutian Islands. At the same time enormous numbers of sea-otter skins were taken. Afterward both English and American ships engaged in the pursuit of otters farther down the coast.

The first year after the discovery of the Pribilof Islands the records show that 5,000 sea otters were taken there. Many expeditions in other directions secured from one to several thousand skins. When sea otters were most abundant they were found all down the coast, even in San Francisco Bay, and one American trading vessel obtained 7,000 skins in a few weeks from the natives of the northern coast of Lower California.

The otters formerly frequented the shores of rocky islands and outlying reefs, but constant persecution has driven the few survivors to remain almost constantly at sea, where they seek resting places among kelp beds. They are now excessively shy and, aided by keen eyes and an acute sense of smell, are difficult to approach. When anything excites their curiosity they commonly raise the body upright, the head high above water, and gaze steadily at the object. If alarmed, they dive and reappear at a long distance.

Otter hunters report the animals very playful in pleasant weather. Sometimes they float on their backs and play with pieces of kelp. The mother is devoted to her young and is said to frolic with it in the water for hours at a time.

All efforts to rear the young in captivity have failed. The food of the sea otter is mainly shellfish of various kinds, secured by them from the bottom of the sea.

Practically the only sea otters left among the hordes which once frequented the American shores of the North Pacific are now scattered along the Aleutian Islands. Government regulations prohibit their being hunted and it is hoped that enough still remain to restock the wild and stormy sea where they have their home.

LITTLE SPOTTED SKUNK: Spilogale putorius and its relatives

(For illustration, see Color Plate, page 70)

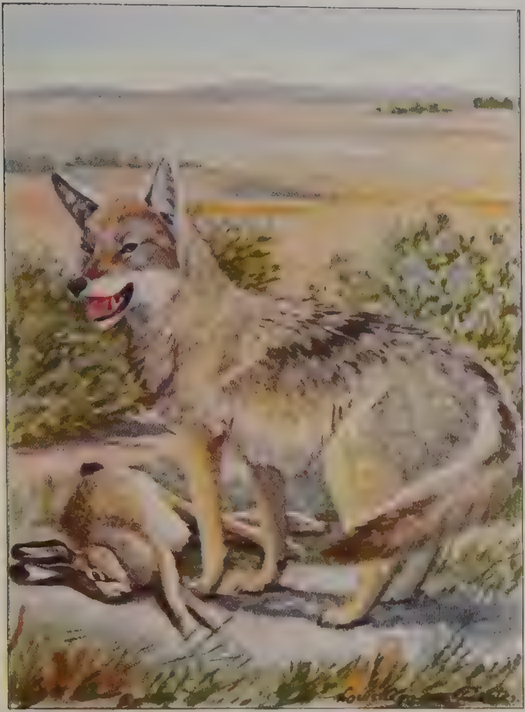
The little spotted skunks are distinguished from all other mammals by the curious and pleasing symmetry of their black and white markings. Few more beautiful fur garments are made than those from the skins of these animals in their natural colors. These skunks are smaller than any members of the other groups, varying from a little larger than a large chipmunk to the size of a fox squirrel.

Little spotted skunks include several species and geographic races. All are limited to North America and are rather irregularly distributed from the Atlantic coast to the Pacific and from Virginia, Minnesota, Wyoming, and southern British Columbia southward to the Gulf coast, to the end of Lower California, and through Mexico and Central America to Costa Rica. They inhabit a variety of climatic conditions, from the rocky ledges high up on the slopes of the Western mountains to the hot desert plains of the Southwest, and to partly forested regions in both temperate and tropical lands. In different parts of the United States they have several other names, including "civet," "civet cat," and "hydrophobia skunk" (see also text, page 81).

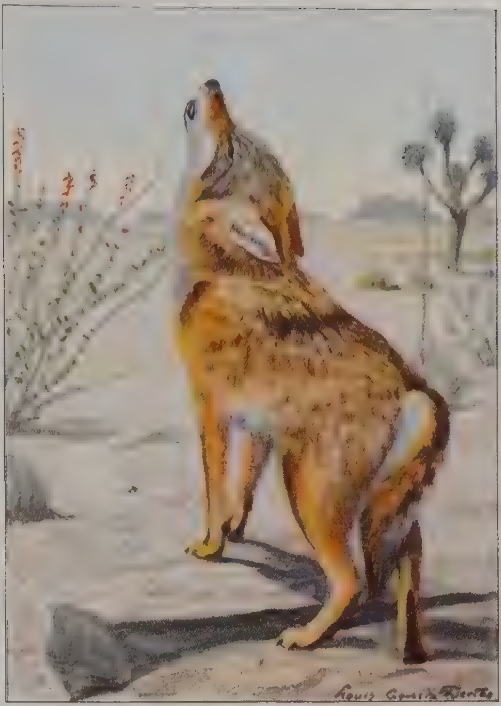
The spotted skunks make their homes in whatever shelter is most convenient, whether it be clefts in rocky ledges, slide rock, hollows in logs or stumps, holes dug by themselves in banks or under the shelter of cacti or other thorny vegetation, the deserted holes of burrowing owls in Florida, or the old dens of various kinds of mammals elsewhere. Thickets, open woods, ocean beaches, and the vicinity of deserted or even occupied buildings on ranches are equally welcome haunts. On the plains of Arizona they have been known to live inside the mummified carcass of a cow, the sun-dried hide of which made an impregnable cover. They have a single litter of from two to six young each year.

Their diet is fully as varied as that of others of the weasel kind, but is made up mainly of insects and other forms injurious to agriculture, including grasshoppers, crickets, beetles, and larvæ of many kinds. They feed also on flesh whenever possible and prey on wood rats, mice of many kinds, small ground squirrels, small birds and their eggs, young chickens, lizards, salamanders, and crawfish. This carnivorous diet is further varied with mushrooms, peanuts, persimmons, cactus fruit, and other small fruits. Sometimes the animals locate about occupied habitations in primitive communities, where they give good service by killing the house rats, mice, and cockroaches on the premises. On one occasion a spotted skunk was detected cunningly removing the downy chicks from under a brooding hen without disturbing her.

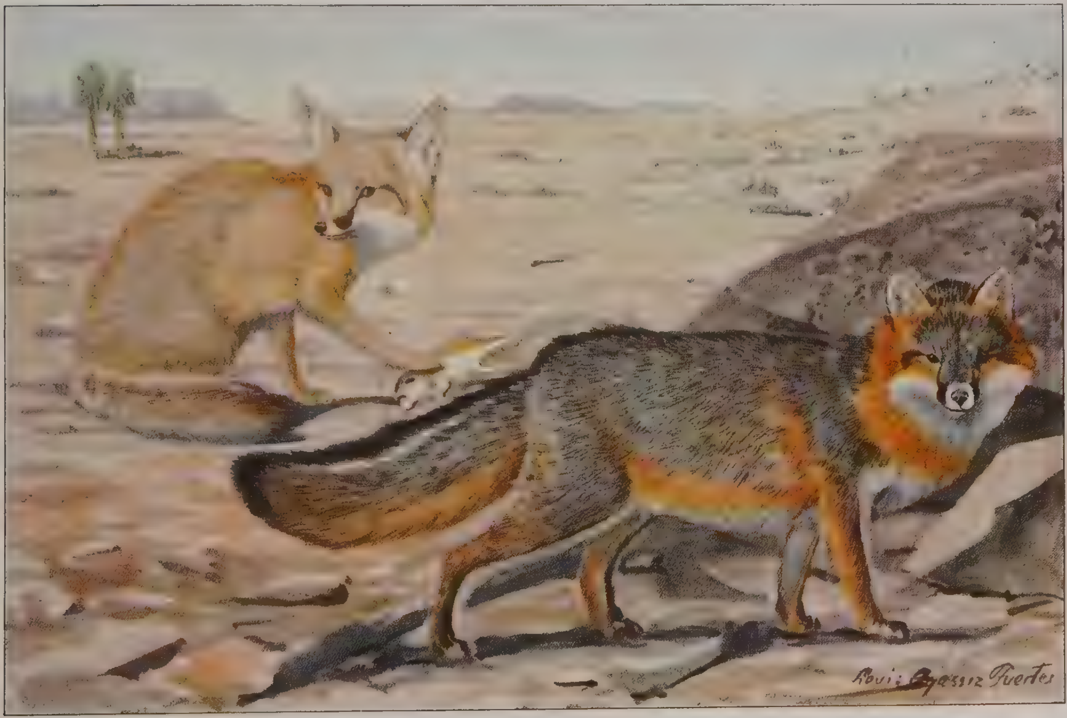
In comparison with the other skunks these little animals are extremely agile. They are strictly nocturnal and when pursued at night by dogs will climb to safety in a tree like a



PLAINS COYOTE, or PRAIRIE WOLF
Canis latrans

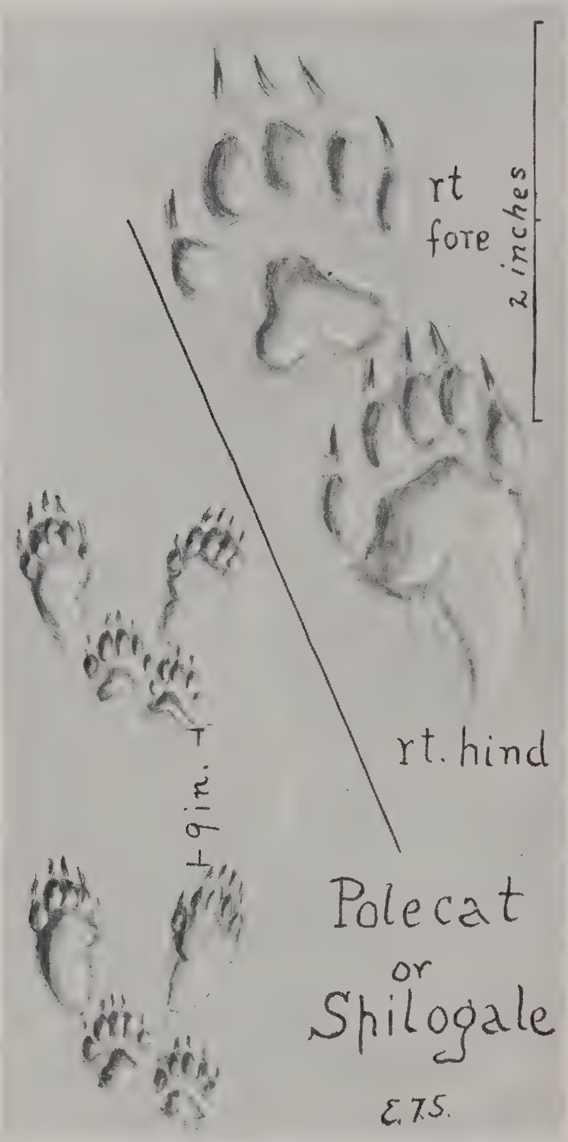


ARIZONA, or MEARNS, COYOTE
Canis mearnsi



DESERT FOX
Vulpes macrotis

GRAY FOX
Urocyon cinereoargenteus



THE TRAIL OF THE LITTLE SPOTTED SKUNK

At first it looks like the track of a stubby-toed squirrel, but the fifth toe on the front foot is plainly seen. The frequent pairing of the fore paws is important. There is no tail mark.

squirrel. When caught in a trap they struggle and fight far more vigorously than their big relatives. They usually carry the tail in a somewhat elevated position, but when danger threatens, they hold it upright like a warning signal. If the enemy fails to take heed, they shoot two little spraylike jets of liquid bearing the usual offensive skunk odor, and the victim retires without honor.

In writing of these skunks about the Valley of Mexico, in 1628, Dr. Hernández tells us that "the powerful arm which they use when in peril is the insupportable gas they throw out behind, which condenses the surrounding atmosphere so that, as one grave missionary says, it appears as though one could feel it."

That the little spotted skunk is subject to rabies and has communicated it to many men in the West is unquestionable. It usually bites men who are sleeping on the ground in its haunts, as they commonly do on the Western stock ranges.

I have personally known of several instances in northern Arizona of men being bitten by them. The head, face, and hands, being uncovered, are the points attacked. One man in the mountains south of Winslow, Arizona, was bitten on top of his head in April, 1910, but paid no attention to the slight wound until two months later when he began to have spasms. He then hurried to town and died in great agony the next day. The year following, a man in the same district was bitten in the face. and seizing the animal threw it from him in such a manner that it fell on his brother and bit him before he awakened. Both men were given the Pasteur treatment and had no further trouble.

On New Year's night of 1906, while I was at the village of Cape San Lucas, at the extreme southern end of the peninsula of Lower California. a large-sized old male spotted skunk entered the open door of a neighboring house and bit through the upper lip of a little girl sleeping on the floor. Her screams brought her father to the rescue, and with a well-aimed blow he killed the offender. The next morning the skunk was brought to me and added to my collection. As I left a few days later, I never learned the result of this bite, but while there I was informed that a man had died the previous year from a similar bite. The occasional instances of this kind are remembered and appear more numerous than they are in fact. For years many men have slept in the open where these animals abound, without being molested. It is interesting to find that when the voyager Duhaut-Cilly visited Cape San Lucas in 1826, the natives feared these skunks because they entered houses at night, biting people and infecting them with hydrophobia.

The little spotted skunks have extremely animated, playful natures, as I have had several occasions to observe. Once at the mouth of a canyon at the southern end of the San Joaquin Valley, California, I camped for several days at a deserted ranch. At night I spread my blankets on the bare floor of the house, from which the doors were gone. Under it led several burrows of some animal which I at first supposed to be a ground squirrel. Each night while there I was awakened by the sound of little footfalls padding rapidly about over the floor on which I was sleeping, and in the dim light from the moon I could see two or three little spotted skunks pursuing one another around me like playful kittens. At the slightest movement on my part they dashed out of the door and into their dens under the house. As there was no food of any kind in this room, it was evident that the little fellows were there for a frolic.

On another occasion in the mountains of San Luis Potosí, on the Mexican table-land, I found a spring to which bears were coming for water at night. As the bears here appeared to be strictly nocturnal, I ensconced myself in the evening amid some small bushes, against a log which sloped downward to the bottom of the gulch near the spring, planning to welcome any bears which might come in. An hour or more after dark, the clinking rattle of small stones on the far side of the gulch indicated the presence of some animal. The light from my dark lantern was flashed on the spot and the rifle lowered with exasperation as, running back and forth, turning over stones in search of insects, a spotted skunk was revealed.

The movements of this unwelcome visitor were extremely light and graceful, and in my interest in watching them, for a time I forgot the bear. After two or three hours, the skunk tired of the hillside and came down to the spring, where he found the offal from a deer which I had placed there for bait. This gave him more to do, and after I had listened to him worry the meat for awhile, I turned on the light and was entertained by the sight thus revealed. The skunk appeared to have a persistent desire to drag away the offal many times his weight. He would seize the edge of one of the lungs and after a hard struggle would get it up on one edge, when the burden would turn over with a flap, whirling the skunk flat on his back each time. Immediately scrambling to his feet, he would give the meat a fierce shake of resentment and repeat the performance.

After a long time the moon rose and the skunk could be plainly seen running back and forth playfully, now biting at the meat and now turning over stones apparently in sheer exuberance of spirit. Then he suddenly mounted the lower end of the log and came galloping up it until he was close to my shoulder. There he stopped and, coming as near as possible, extended his nose within a few inches of my face, and for a minute or more stood trying to satisfy himself about this strange object. Satisfied at last, he turned and galloped back down the log and resumed his antics in the gulch, finally working close to the bank three or four yards below me. There he found many small stones and had a fine time rattling them about until I decided that with this disturbing presence I should have little chance for other game. Finding a convenient stone, and locating the skunk from the sounds, I tossed it over to try to frighten him away. My aim was too true, for the characteristic skunk retort filled the air with suffocating fumes and I immediately lost interest in further bear hunting.

COMMON SKUNK: Mephitis mephitis
and its relatives

(*For illustration, see Color Plate, page 70*)

Probably no American mammal is more generally known and less popular than the skunk. This current odium is due wholly to its possession of a scent sac of malodorous fluid, which it distributes with prompt accuracy when annoyed. The possession of this method of defense is common to all skunks. The term "polecat," sometimes given to all kinds of skunks, is the misuse of a name given Old World martens of several species and to the Cape polecat, a South African animal which in form and markings, including the plumelike tail, is remarkably like some of our smaller skunks.

In the preceding article an account was given of the spotted skunks, smallest of the three groups into which these animals are divided. The common skunk and its relatives form another group, which contains some of the larger species of their kind, some of them weighing up to ten pounds or more. These are the typical skunks, so familiar in most parts of the United States, and distinguished by the disproportionately large size of the posterior half of the body and the long, plumelike tail.

The common skunk, with its closely related species, is generally distributed in all varieties of country, except in deep forests and on waterless desert plains. It ranges from the Atlantic coast to the Pacific and from Hudson Bay and Great Slave Lake southward to the highlands of Guatemala. The vertical range extends from sea level up to above timberline in Mexico, where I found one living in a burrow it had dug under a rock at 13,800 feet altitude on the Cofre de Perote, Vera Cruz.

Skunks are most common in areas of mixed woodland and fields, in valley bottoms, and along the brushy borders of creeks and rocky canyons. One of their marked characteristics is a fondness for the vicinity of man. They frequently visit his premises, taking up quarters beneath outbuildings or even under the house itself.

Any convenient shelter appears to satisfy them for a home, and they will occupy the deserted burrows of other animals, small cavities among the rocks, a hollow log, or a hole dug by themselves. A warm nest of grass and leaves is made at the end of the den, where the single litter of young, containing from four to ten, is born in April or May. As soon as the young are old enough they follow the mother, keeping close behind her, often in a long single file along a trail. They are mainly nocturnal, but in summer the mother frequently starts out on an excursion with her young an hour or two before sunset and they may remain abroad all night.

The young family remains united through the following winter, which accounts for finding at times from eight to a dozen in a den. In all the northern parts of their range they hibernate during the two to four months of severest cold weather, coming out sometimes during mild periods. When the season of hibernation ends the family scatters and mating begins. One solitary skunk was found in Canada hibernating in the same burrow, but in a separate chamber, with a woodchuck, evidently an unbidden guest.

As in the case of their relatives, the common skunks are omnivorous, but feed mainly upon insects and rodents injurious to agriculture. They are known to eat great quantities of grasshoppers, besides crickets, cicadas, May beetles, wasps, and larvæ of many kinds. One killed in New Mexico had its stomach crammed with honeybees. Wherever possible they prey upon small rodents, as mice, wood rats, and small spermophiles. To these may be added ground-nesting birds and their eggs, lizards, turtle eggs, snakes, frogs, salamanders, fish, crustaceans, and numerous small fruits. Now and then they visit the farmer's chicken yards with such disastrous consequences that in many country districts the animals are killed at sight.

It is pleasing to record that a more intelligent view of their real value to farmers, through their destruction of farm pests, is rapidly gaining ground, and they are now being protected in many States. One of their worst traits is their destructiveness to breeding game birds, both upland species, and more especially the waterfowl.

Skunks walk on the soles of their feet instead of on their toes, as do so many mammals. The common skunk is wholly terrestrial and moves with the deliberation of one without fear of personal violence or of having his dignity assailed. Long experience has taught him that the right of way is his. As he ambles slowly along, the tail is carried slightly elevated, and when the owner becomes suspicious of attack, it is raised and the hairs hang drooping like a great plume, conspicuous and unmistakable. If the disturber still refuses to take the hint, a rear view is promptly presented and a discharge made that puts most enemies to flight. Some have thought that the malodorous liquid is scattered by the long hairs of the tail, but it is ejected in jets from two little tubes connected with the scent sacs on each side of the vent.

When mildly annoyed the big skunks stamp their front feet on the ground and utter little growls of displeasure. By some effort they can be urged into a retreat which may take the form of a clumsy gallop. They are known occasionally to swim streams voluntarily, and even to cross rivers, probably urged by the instinct that so often forces animals of all kinds to move to new feeding grounds.

Although usually safe from annoyance through the protective armament, many skunks, especially the young, each year fall victim to natural enemies, including wolves, coyotes, foxes, badgers, and great horned owls.

The flesh of the skunk is a favorite food among certain tribes of Canadian Indians, and many white men have pronounced it exceedingly palatable, even claiming its superiority over the flesh of domestic fowls. In the narrative of his expedition through the Canadian wilderness many years ago, the naturalist Drummond recorded that when the party was about a day's journey from Carleton House it had the good fortune to kill a skunk, "which afforded us a comfortable meal." In the Valley of Mexico I found that the natives prize the flesh of these animals as a cure for a certain loathsome disease.

It is well known that large skunks are often extremely fat. The oil produced from them is clear and is said to have unusually penetrating qualities. For many years there was a demand for this oil for various medicinal purposes.

During recent years the fur of skunks has come into great demand, and good prices are paid for prime skins. The animals are so numerous and the catch is so large that they now rank among the most valuable of our fur bearers. They are gentle animals which readily become domesticated and breed freely in confinement, and many efforts are being made to establish skunk farms. Success in such farming depends wholly on the outlay for upkeep. Skunk farming will probably pay better as a side line, like chickens on the ordinary farm, than to establish regular fur farms. The scent sac may be removed by a slight surgical operation, so there need be no trouble from that source. Common skunks when taken young make affectionate and entertaining pets.

HOG-NOSED SKUNK: Conepatus mesoleucus and its relatives

(*For illustration, see Color Plate, page 72*)

The third and last group of skunks contains a number of species showing well-marked differences from the two groups already described. The species vary in size, but among them is included the largest of all skunks. All are characterized by comparatively short hair, especially on the tail, and this appendage lacks the plumelike appearance observed in other skunks. The nose is prolonged into a distinct "snout," naked on the top and sides and evidently used for rooting in the earth after the manner of a pig. In addition, the front feet are armed with long, heavy claws, and the front legs and shoulders are provided with a strong muscular development for digging, as in a badger. This likeness has led to the use of the name "badger skunk" for these animals. The single white stripe along the back and tail is a common pattern with these skunks, but the marking is varied, as in the common species.

The hog-nosed skunks are the only representatives of the skunk tribe in South America, where various species occupy a large part of the continent. They appear to form a South American group of mammals which has extended its range northward through Central America, Mexico, and across the border of the United States to central Texas, New Mexico, and Arizona. In Mexico they range from sea level to above 10,000 feet altitude.

The hair on these skunks is coarse and harsh, lacking the qualities which render the coats of their northern relatives so valuable. Where their range coincides with that of the common skunks, the local distribution of the two is practically the same.

For shelter they dig their own burrows, usually in a bank, or under a rock, or the roots of a tree, but do not hesitate to take possession of the deserted burrows of other animals, or of natural cavities among the rocks. Because of their strictly nocturnal habits, they are much less frequently seen than the common skunks, even in localities where they are numerous.

Although both the little spotted and common skunks live mainly on insects, the hog-nosed skunks are even more insectivorous in their feeding habits. The bare snout appears to be used constantly for the purpose of rooting out beetles, grubs, and larvæ of various kinds from the ground. The persistence with which it hunts insects renders the hog-nosed skunk a valuable aid to farmers.

In addition to grasshoppers, crickets, beetles, flies, grubs, and other larvæ, and many other insects, they are known to eat wood rats, mice, and the small fruit of cacti and other plants.

One Texas naturalist writes that he has lost a number of young kids which had their noses bitten off, and in one instance he caught one of these skunks mutilating a kid thus. He also states that they pull down and eat corn when it is in the "roasting-ear" stage.

Far less is known concerning the habits of hog-nosed skunks than of the other species of these animals. The number of young appears to be small, judging from the record of a single embryo found in one animal and in another instance of two young found in a nest located in a hollow stump. They have a curiously stupid, sluggish manner. No use is made of their skins in this country, but the gigantic natives of Patagonia make cloaks of them.

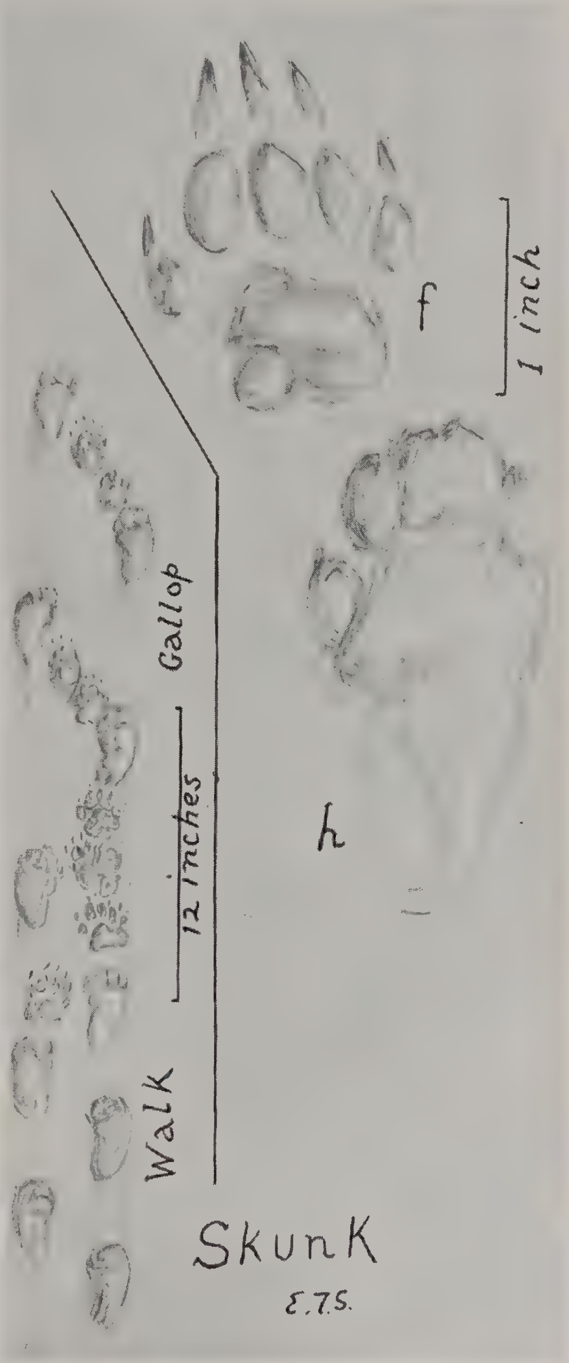
AMERICAN BADGER: **Taxidea taxus** and its subspecies

(*See Color Plate, page* 72)

The American badger is a close relative of the well-known badger occupying the British Isles and other northern parts of the Old World. It is a low, broad, short-legged, powerfully built animal of such wide distribution that it has developed several geographic races. Its range originally extended from about 58 degrees of latitude, on the Peace River, in Canada, south to the plains of Puebla, on the southern end of the Mexican tableland, and from Michigan, Kansas, and Texas west to the Pacific coast. It is now extinct over much of this area and is everywhere greatly reduced in numbers.

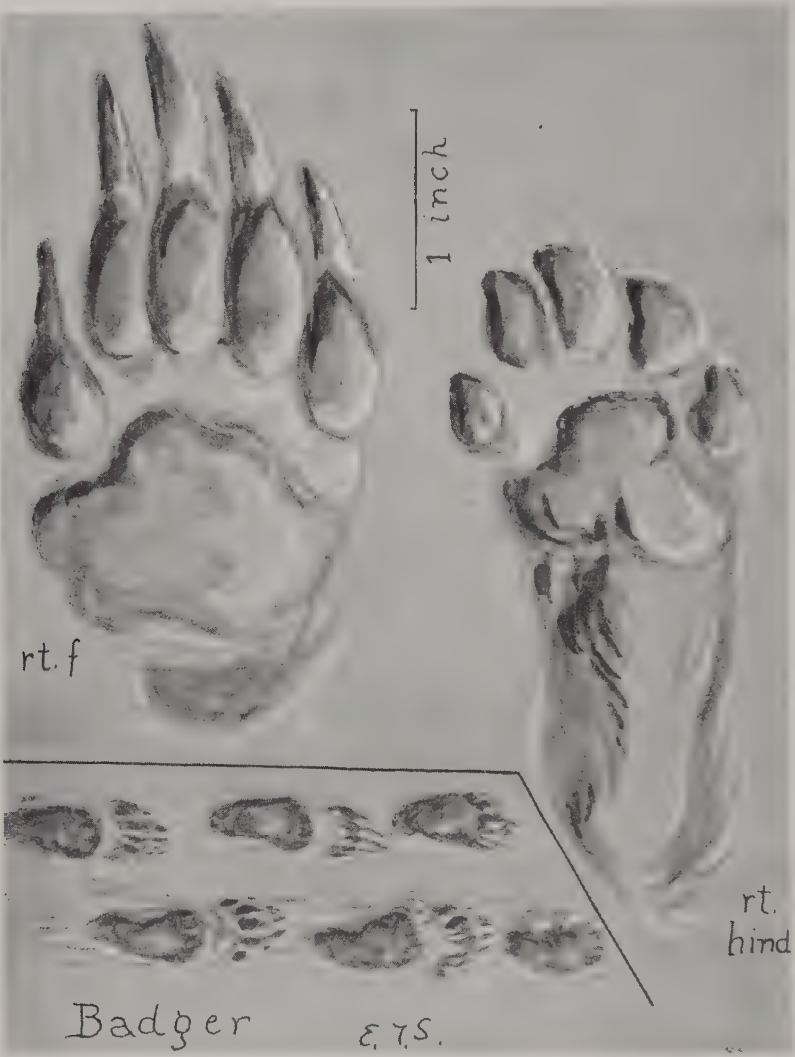
It appears to thrive equally well on the plains of Alberta, in the open pine forests of the Sierra Nevada in California; and on the dry lowlands in southern Lower California.

The favorite home of the badger is on grassy, brush-grown plains, where there is an abundance of mice, pocket gophers, ground squirrels, prairie-dogs,



THE TRAIL OF THE COMMON SKUNK

The hindfoot of this species rarely shows the claws in the track. The peculiarity presents a marked contrast to the track of the little spotted skunk reproduced on page 80. The diagonal set (above) during the gallop is characteristic. Such tracks are not rare, for skunks have a fondness for the vicinity of man.



HUGE FORE CLAWS ARE A STRONG FEATURE OF BADGER TRAILS

The spread of the tracks in the lower trail corresponds with the low, thick form of the animal.

or other small mammals. There it wanders far and wide at night searching for the burrows of the small rodents, which are its chief prey. When its acute sense of smell announces that a burrow is occupied, it sets to work with sharp claws and powerful forelegs and digs down rapidly to the terrified inmate.

The trail of a badger for a single night is often marked by hole after hole, each with a mound of fresh earth containing the tracks of the marauder. As a result, if several of these animals are in the neighborhood, their burrows, six or eight inches in diameter, soon become so numerous that it is dangerous to ride rapidly through their haunts on horseback.

Although a member of the weasel family, the badger is so slow-footed that when it is occasionally found abroad by day a man on foot can easily overtake it. When brought to bay, it charges man or dog and fights with such vicious power and desperation that nothing of its own size can overcome it.

Although commonly found living by itself in a den, it is often seen moving about by day in pairs, indicating the possibility that it may mate permanently. In the northern part of its range it hibernates during winter, but in the south it remains active throughout the year. Its shy and retiring character is evidenced by the little information we have concerning its family life.

The badger is so destructive to rodents that its services are of great value to the farmer. Regardless of this, where encountered it is almost invariably killed. As a result, the increasing occupation of its territory must result in its decrease in numbers and final extermination.

CHAPTER V

Red and Kit Foxes, Gray Foxes, Arctic and Blue Foxes, Coyotes and Wolves, Jaguar and Tiger Cats, Mountain Lion, Eyra, and Lynx

THE *Canidæ,* or dog family, with its near relatives, consists of genera and species differing considerably in appearance but with certain marked resemblances that plainly indicate their relationship. They occur in nearly all parts of the world, even including Australia, where a wild dog, the dingo, is a native member of the fauna. It is one of the extremely few native species of that land not a marsupial. Among the members of this family are dogs, wolves, coyotes, jackals, fennecs, and foxes.

The members of the Genus *Vulpes,* red, kit, and desert foxes, may be termed the true foxes. Their distribution is mainly in the Northern Hemisphere. Several species and geographic races of the red fox are widely distributed in North America, and on the treeless Plains of the West also live the smaller and more delicately formed kit and desert foxes. Only the latter cross the line into Mexico.

Gray foxes, Genus *Urocyon,* are peculiar to America, where they range over much of the United States and southward to northern Colombia. They may be at once distinguished from the red foxes, which they resemble in size, by their iron-gray color and the thin tail which is broad vertically but comparatively narrow laterally, thus contrasting with the bushy, round tails of the others.

The foxes of the Arctic ice pack and the treeless islands and tundras bordering northern seas are smaller and more heavily furred than the red foxes; they also have shorter noses and shorter, more rounded ears. They belong to the Genus *Alopex.*

Species belonging to the Genus *Canis,* which includes dogs, wolves, and coyotes, occur in many parts of the world, especially in the Northern Hemisphere.

The large gray wolves and the coyote are well known in North America, but are replaced by representatives of other genera of the dog family in South America.

The cats, which belong to the Family *Felidæ,* form the most highly developed group of carnivores existing in the present fauna of the world. They are nearly all provided with very sharp, recurved claws, guarded in sheaths until needed for use, and sharply pointed and edged teeth, perfectly devised to capture and kill their prey. In addition, their eyes are so constructed that they can hunt either by night or by day.

The cats vary in weight from a few pounds, in the common house cat, to more than 600 pounds in a full-grown male lion or tiger.

They are distributed in most parts of the world, except in Australia, oceanic islands, and the Polar regions. In North America they are represented by mountain lions, jaguars and other spotted cats, the eyras and lynxes.

The Genus *Felis,* comprising the typical cats, includes all of the most widely known members of the cat family, beginning with the house cat, descended from wild ancestors in northern Africa, and embracing the lion, tiger, and leopards of the Old World, and the mountain lion, jaguar, and tiger cats of the Americas.

The eyra, or jaguarundi, cat, sole member of the Genus *Herpailurus,* is strictly tropical American in distribution. Its long, slender body and tail and short legs give it an otterlike form.

Another peculiarity that separates the eyra from nearly all other cats of the world is the unspotted coat of the young, which are born with the plain colors of their parents.

Cats of the Genus *Lynx,* comprising the lynxes, or short-tailed cats, are generally distributed in forested areas of the northern and temperate regions of the Northern Hemisphere. They may be distinguished at once from others of the cat tribe by their short, stubby tails.

Two distinct species of lynxes occur in North America, the Canada lynx and the bobcat.

AMERICAN RED FOX: Vulpes fulva
and its relatives

(*For illustration, see Color Plate, page 77*)

Red foxes are characterized by their rusty-red fur, black-fronted forelegs, and white-tipped tail. They inhabit the forested regions in the temperate and subarctic parts of both Old and New Worlds, and, like most other types of animal life having a wide range, they break up into numerous distinct species and geographic races.

In America they originally ranged over nearly all the forested region from the northern limit of trees in Alaska and Canada, east of the Great Plains, to Texas; also down the Rocky Mountains to middle New Mexico, and down the Sierra Nevada to the Mount Whitney region of California. They are unknown on the treeless Plains of the West, including the Great Basin. Originally they were apparently absent from the Atlantic and Gulf States from Maryland to Louisiana, but have since been introduced and become common south to middle Georgia and Alabama.

Wherever red foxes occur they show great alertness and capacity in meeting the requirements of their surroundings. In New England they steadily persist, though their raids on poultry yards have for centuries set the hand of mankind against them. For a time conditions favored them in parts of the Middle Atlantic States, for the sport of hunting to hounds was imported from England, and the foxes had partial protection. This exotic amusement has now almost passed and the fox must everywhere depend on his nimble wits for safety.

Since the days of Æsop's fables tales of foxes and their doings have had their place in literature as well as in the folklore of the countryside. Many of their amazing wiles in outwitting pursuers or in capturing their prey give evidence of extraordinary mental powers.

Their bill of fare includes many items, as mice, birds, reptiles, insects, many kinds of fruits, and an occasional chicken. The bad name borne by them among farmers, due to occasional raids on the poultry yard, is largely unwarranted. They kill enormous numbers of mice and other small rodents each year, and thus well repay the loss of a chicken now and then.

Red foxes apparently pair for life and occupy dens dug by themselves in a secluded knoll or among rocks. These dens, which are sometimes occupied for years in succession, always have two or more entrances opening in opposite directions, so that an enemy entering on one side may be readily eluded. The young, numbering up to eight or nine, are tenderly cared for by both parents.

Although they have been persistently hunted and trapped in North America since the earliest times, they still yield a royal annual tribute of furs. It is well known that the highly prized cross, as well as the precious black, and silver-gray foxes are merely color phases occurring in litters of the ordinary red animal. At one time black fox skins were so highly prized that specially fine ones have sold for more than $2,500 each in the London market. The reward thus offered resulted in the development of black fox fur farms, which have been very successful in parts of Canada and the United States. This development has given rise to a valuable new industry which has extended to other parts of the world and has reached a stage of production that has greatly lowered the prices of prime skins.

By the modern regulation of trapping, foxes and other fur bearers are destined to survive wherever conditions are favorable. In addition to the economic value of foxes, the location of an occasional fox den here and there on the borders of a woodland tract, the meandering tracks in the snow, and the occasional glimpse of animals cautiously making their rounds, add a keen touch of primitive nature well worth preserving in any locality.

ALASKA RED FOX: Vulpes alascensis

(*For illustration, see Color Plate, page 77*)

The red fox of the Kenai Peninsula, Alaska, and the adjacent mainland is probably the largest of its kind in the world, although those of Kodiak Island and of the Mackenzie River Valley are nearly as large. Compared with its relatives of the United States, the Kenai fox is a giant, with heavier, duller-colored coat and a huge tail, more like that of a wolf than of a fox. The spruce and birch forests of Alaska and the Mackenzie Valley are apparently peculiarly adapted to red foxes, as shown by the development there of these animals—good illustrations of the relative increase in size and vigor of animals in a specially favorable environment.

As noted in the general account of the red foxes, the occurrence of the black phase is sporadic, and the relative number of dark individuals varies greatly in different parts of their range. The region about the upper Yukon and its tributaries and the Mackenzie River basin are noted for the number of black foxes produced, apparently a decidedly greater proportion than in any other similarly large area. The prices which these black skins command in the London market prove them to be of equal quality with those from any other area.

Like other red foxes, the Alaskan species digs its burrows, with several entrances, in some dry secluded spot, where both male and female share in the care of the young. In northern wilds the food problem differs from that in a settled country. There the surrounding wild life is the only dependence, and varying hares, lemmings, and other mice are usually to be had by the possessor of a keen scent and an active body. In summer many nesting wild fowl and their young are easy prey, while heathberries and other northern fruits are also available.

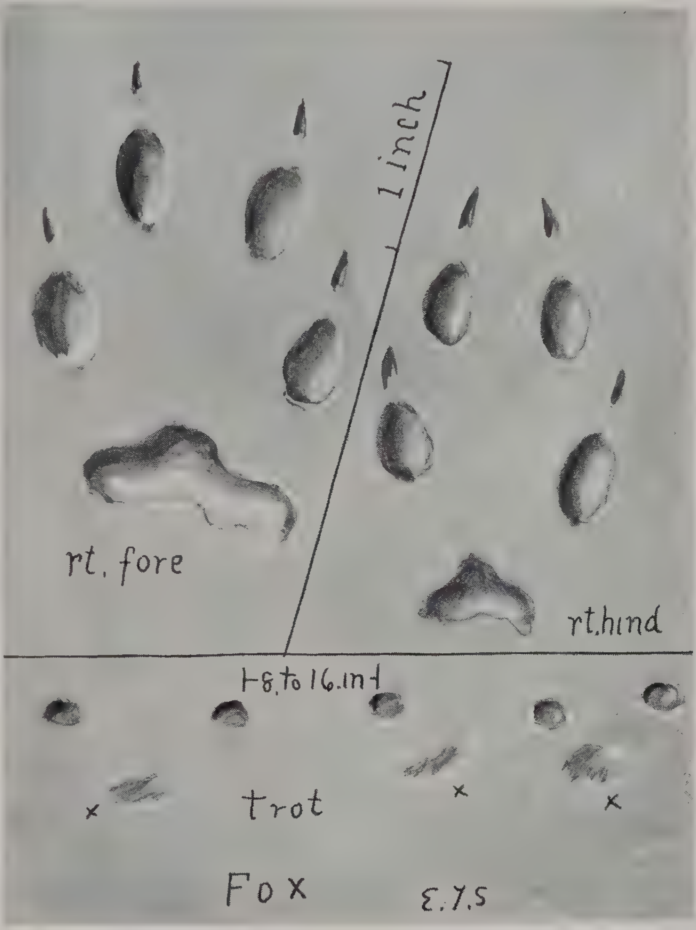
Winter brings a season of scarcity, when life requires the exercise of every trained faculty. The snow-white ptarmigan is then a prize to be gained only by the most skillful stalking, and the white hare is almost equally difficult to secure. At this season foxes wander many miles each day, their erratic tracks in the snow telling the tale of their industrious search for prey in every likely spot. It is in this season of insistent hunger that many of them fall victims to the wiles of trappers or to the unscrupulous hunter who scatters poisoned baits.

Fortunately the season for trapping these and other fur bearers in Alaska is now limited by law and the use of poisons is forbidden. These measures will aid in preserving one of the valuable natural assets of these northern wilds.

DESERT FOX: Vulpes macrotis and its subspecies

(*For illustration, see Color Plate, page* 79)

A small fox, akin to the kit fox or swift of the Western Plains, frequents the arid cactus-grown desert region of the Southwest. It is found from the southern parts of New Mexico, Arizona, and California south into the adjacent parts of Mexico. The desert fox is a beautiful species, slender in form, and extraordinarily quick and graceful in its movements but so generally nocturnal in habits as to be rarely seen by the desert traveler. On the rare occasions when one is encountered abroad by day, if it thinks itself unobserved by the traveler it usually flattens itself on the ground beside any small object which breaks the surface, and thus obscured will permit a horseman to ride within a few rods without moving. If the traveler indicates by any action that he has seen it, the fox darts away at extraordinary speed, running with a smooth, floating motion which seems as effortless as that of a drifting thistledown before a breeze.



THE TRACK OF A RED FOX

The size, the small pads, and the set of all feet nearly in one line are strong features, as also is the tail touch.

The desert fox digs a burrow, with several entrances, in a small mound, or at times on an open flat, and there rears four or five young each year. Its main food consists of kangaroo rats, pocket mice, small ground squirrels, and a variety of other small desert mammals. In early morning fox tracks, about the size of those of a house cat, may be seen along sandy arroyos and similar places where these small carnivores have wandered in search of prey.

Like the kit, the desert fox has little of the sophisticated mental ability of the red fox and falls an easy prey to the trapper. It is nowhere numerous, but it occupies such a thinly inhabited region that there is little danger of its numbers greatly decreasing in the near future.

GRAY FOX: Urocyon cinereoargenteus and its relatives

(*For illustration, see Color Plate, page* 79)

Gray foxes average about the size of common red foxes, but are longer and more slender in body, with longer legs and a longer, thinner tail. They are peculiar to America, where they have a wide range—from New Hampshire, Wisconsin, and Oregon south through Mexico and Central America to Colombia. Within this area there are numerous geographic forms closely alike in color and general appearance, but varying much in size. The largest of all, larger than the red fox, occupies the New England States.

Gray foxes inhabit wooded and brush-grown country and are much more numerous in the arid or semiarid regions of the southwestern United States and western Mexico than elsewhere. In parts of California they are far more numerous than red foxes ever become. They do not regularly dig a den, but occupy a hollow tree or cavity in the rocks, where they bring forth from three to five young each spring. As with other foxes, the cubs are born blind and helpless, and are also almost blackish in color, entirely unlike the adults. The parents, as usual with all members of the dog family, are devoted to their young and care for them with the utmost solicitude.

Like other members of the tribe, they are omnivorous and feed upon mice, squirrels, rabbits, birds, and large insects, in addition to acorns or other nuts and fruits of all kinds. In Lower California they are very common about the date-palm orchards, which they visit nightly for fallen fruit. They also make nocturnal visits to poultry yards.

In some parts of the West they are called "tree foxes," because when pursued by dogs they often climb into the tops of small branching trees.

On one occasion in Arizona I saw a gray fox standing in a top of a large, leaning mesquite tree, about thirty feet from the ground, quietly gazing in various directions, as though he had chosen this as a lookout point. As soon as he saw me he came down at a run and swiftly disappeared.

In the same region I found a den in the hollow base of an old live oak containing three young only a few days old. The mother was shot as she sprang from the hole on my approach and the young taken to camp. There the skin of the old fox, well wrapped in paper, was placed on the ground at one side of the tent, and an open hunting bag containing the young placed on the opposite side about ten feet away. On returning an hour later, I was amazed to find that all three of the young, so small they could crawl only with the utmost difficulty, and totally blind, had crossed the tent and managed to work their way through the paper to the skin of their mother, thus showing that the acute sense of smell in these foxes becomes of service to them at a surprisingly early age.

WHITE, OR ARCTIC, FOX: Alopex grœnlandicus

(*For illustration, see Color Plate, page 74*)

The Arctic fox, clothed in long, fluffy white fur, is an extremely handsome animal, about two-thirds the size of the common red fox. It is a circumpolar species, which in America ranges over all the Barren Grounds beyond the limit of trees, including the coastal belt of tundra from the peninsula of Alaska to Bering Strait, the Arctic islands, and the frozen sea to beyond 83 degrees of latitude.

The blue fox of commerce is a color phase of this species, usually of sporadic occurrence, like the black phase of the red fox. The white fox makes its burrow either in a dry mound, under a large rock, or in the snow, where its young are brought forth and cared for with the devotion which appears to characterize all foxes.

How this small and delicately formed animal manages to sustain life under the rigorous winter conditions of the Far North has always been a mystery to me. I have seen its tracks on the sea ice miles from shore. It regularly wanders far and wide over these desolate icy wastes, which can offer only the most remote chance for food. However, it appears to thrive, with other animal life, even where months of continuous night follow the long summer day.

The food of the Arctic fox includes nearly all species of the wild fowl which each summer swarm into the Far North to breed. There, on the tundras, congregate myriads of ducks, geese, and waders, while on the cliffs and rocky islands are countless gulls and other water birds. In winter they find lemmings and other northern mice, occasional Arctic hares and ptarmigan, as well as fragments of prey left by Arctic wolves or polar bears. Now and then the carcass of a whale is stranded or frozen in the ice, furnishing an abundance of food, sometimes for a year or more, to the foxes which gather about it from a great distance.

Perhaps owing to its limited experience with man, the northern animal is much less suspicious than the southern red fox. During winter sledge trips in Alaska I frequently had two or three of them gather about my open camp on the coast, apparently fascinated by the little campfire of driftwood. They would sit about near by in the snow for an hour or two in the evening, every now and then uttering weak, husky barks like small dogs.

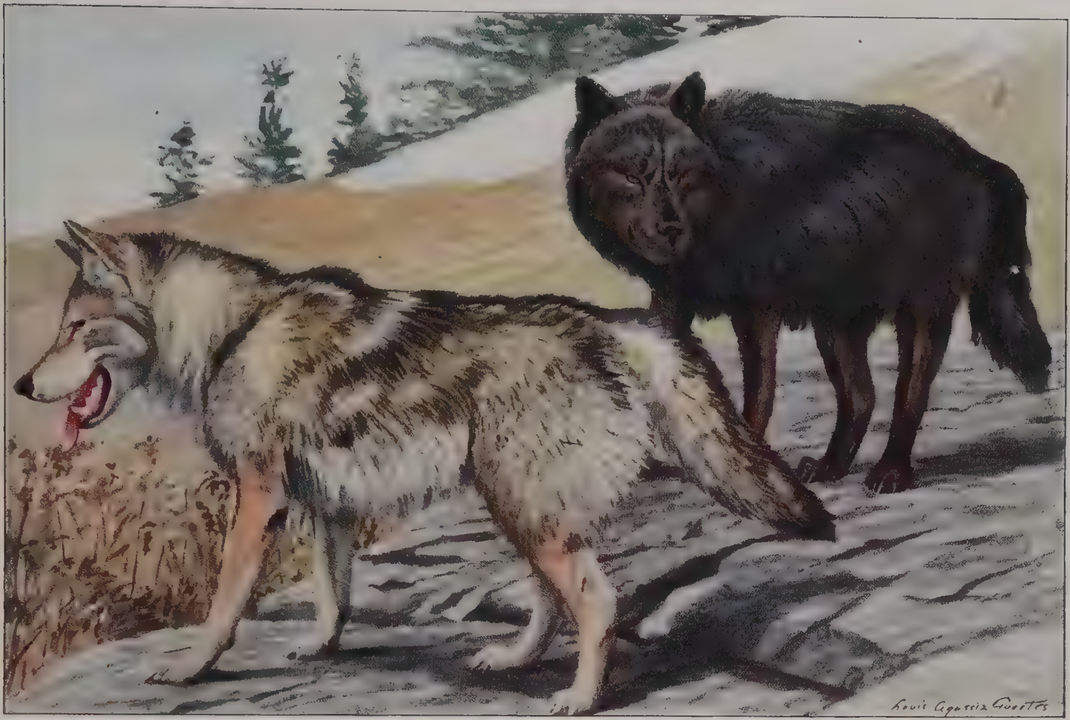
The summer of 1881, when we landed from the *Corwin* on Herald Island, northwest of Bering Strait, we found many white foxes living in burrows under large scattered rocks on the plateau summit. They had never seen men before and our presence excited their most intense interest and curiosity. One and sometimes two of them followed closely at my heels wherever I went, and when I stopped to make notes or look about, sat down and watched me with absurd gravity. Now and then one at a distance would mount a rock to get a better view of the stranger.

On returning to the ship, I remembered that my notebook had been left on a large rock over a fox den on the island, and at once went back for it. I had been gone only a short time, but no trace of the book could be found on or about the rock, and it was evident that the owner of the den had confiscated it. Several other foxes sat about viewing my search with interest and when I left they followed me to the edge of the island. A nearly grown young one kept on the *Corwin* was extraordinarily intelligent, inquisitive, and mischievous, and afforded all of us much amusement and occasional exasperation.

PRIBILOF BLUE FOX: Alopex pribilofensis

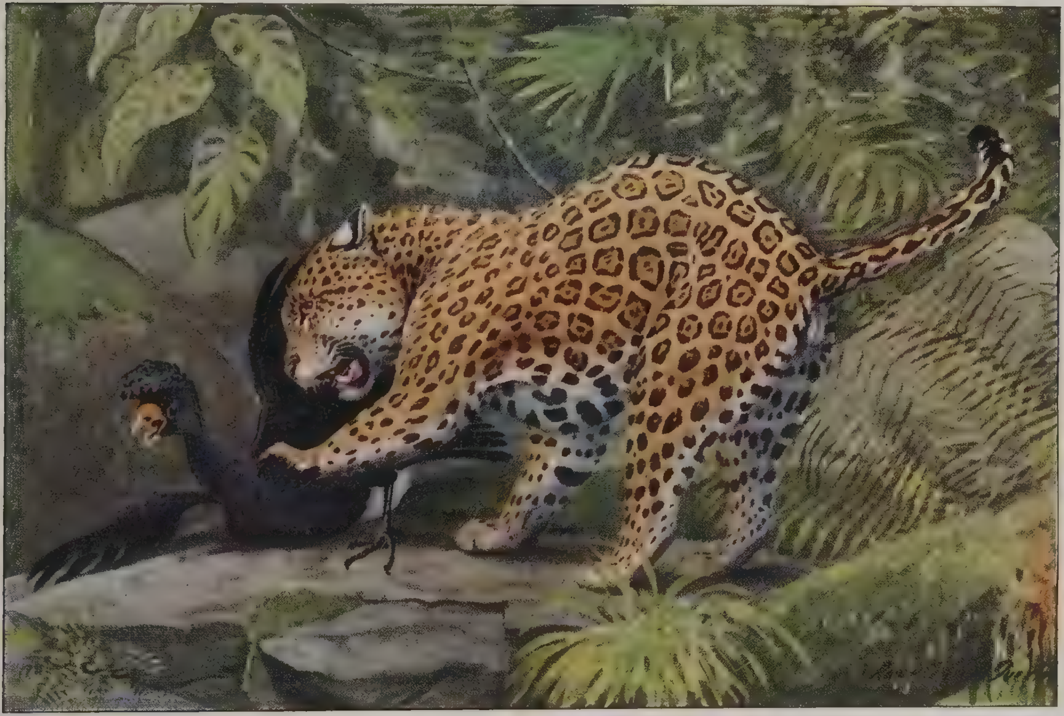
(*For illustration, see Color Plate, page 74*)

The blue fox is a color phase of the Arctic white fox and may occur anywhere in the range of the typical animal. In fact, the blue phase


Louis Agassiz Fuertes

AMERICAN GRAY, or TIMBER, WOLF
Canis lycaon

BLACK WOLF
A color phase of the gray wolf



MEXICAN JAGUAR
Felis hernandesii

bears the same relationship to the white that the black phase does to the red fox. In the Pribilof Islands of Alaska, however, through the influence of favorable climatic conditions, assisted by artificial selection in weeding out white animals, the blue phase has become the resident form. Isolation on these islands has developed other characters also which, with the prevailing color, render the Pribilof animal a distinct geographic race of the white species. A blue fox is also the prevailing resident animal in Iceland.

In years when fur seals were killed in considerable numbers on the Pribilofs, their carcasses remained on the killing grounds as a never-failing store of food through the winter. During summer there is an abundance of nesting waterfowl, and throughout the year there are mice on land and the products of the sea alongshore. As a result, the foxes have thrived amazingly and several hundred skins have been produced a year. The Pribilof skins are of high market value, bringing from $40 to $150 each in the fur markets.

Stock from the Pribilofs has been introduced on a number of the Aleutians and other Alaskan islands for fur-farming purposes. The value of these fur bearers is so great that special effort should be made not only to keep up the stock on the islands, but still further to improve it.

The Pribilof foxes have from five to eleven young, which are usually born above ground and are later carried to the shelter of dens dug in the open or under the shelter of a rock. Foxes have become so accustomed to people on these islands that they have little fear and come about boldly to satisfy their curiosity or to seek for food. They often show an amusing interest in the doings of any one who invades the more remote parts of their domain. White animals born on the islands, or coming in by chance when the pack ice touches there in winter, are killed whenever possible in order to hold the blue strain true.

PLAINS COYOTE, OR PRAIRIE WOLF: Canis latrans

(*For illustration, see Color Plate, page* 79)

Western North America is inhabited by a peculiar group of small wolves known as "coyotes," this being a Spanish corruption of the Aztec name *coyotl*. They range from northern Alaska and the Mackenzie River Delta south to Costa Rica, and from northern Michigan, western Iowa and Texas to the Pacific coast. As a group, they are animals of the open plains and sparsely wooded districts, ranging from sea level to above timber-line on the highest mountains. They are most at home on the wide brushy or grassy Plains of the western United States and the table-lands of Mexico.

Within their great area coyotes have developed several distinct species and a number of geographic races, distinguished by differences in size, color, and other characteristics. Some attain a size almost equaling that of the gray wolf, while others are much smaller.

They are less courageous and have less of the social instinct than gray wolves, and on the rare occasions when they hunt together, no doubt they form a family party, including the young of the year. They appear to pair more or less permanently and commonly hunt in couples. The young, sometimes numbering as many as fourteen, are born in a burrow dug in a bank, or in a den among broken rocks and ledges. Young animals are readily tamed, and it is entirely probable that some of the dogs found by early explorers among western Indians may have descended from coyotes.

Coyotes are a familiar sight to travelers in the wildest parts of the West. Here and there one is seen trotting through the sagebrush or other scrubby growth, or stopping to gaze curiously at the intruder. If suddenly alarmed, they race away across the plains with amazing speed. At night their high-pitched, wailing howls voice the lonely spirit of waste places.

With the growth of settlement in the West and the steady decrease of large and small game, coyotes have become more and more destructive to poultry and all kinds of live stock. As a result, every man's hand is against them, reinforced by gun, trap, and poison. Despite years of this persistent warfare, their acute intelligence, aided by their extraordinary fecundity, has enabled them not only to hold their own over a great part of their original range but to extend it eastward to northern Michigan and to the mouth of the Mackenzie River, within the Arctic Circle. Their depredations upon live stock have been so great that many millions of dollars have been paid in bounties for their destruction.

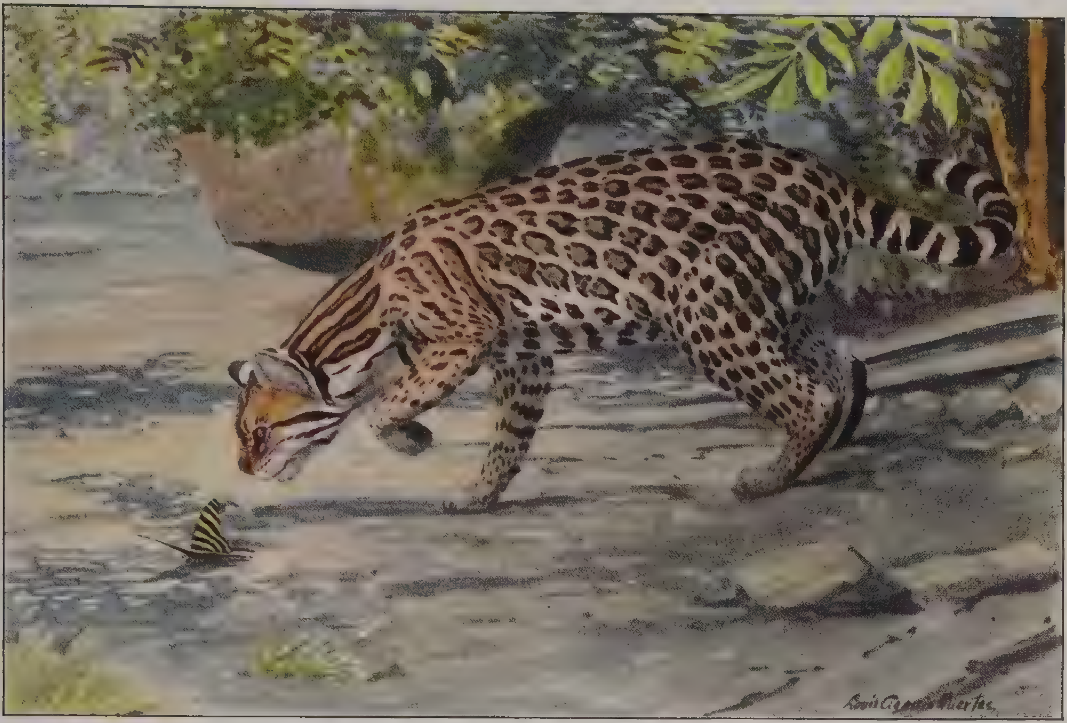
This method of control has proved so ineffective, however, that the Federal Government has engaged in the task of suppressing them, together with the other less numerous predatory animals of the West. At times it has had in the field for this purpose as many as 600 hunters. The complete destruction of coyotes would, to a certain degree, favor the increase of rabbits, prairie dogs, and other harmful rodents, but not to a very serious extent. Where the coyotes are unmolested, rodents still increase and become destructive pests.

The coyote supplies much interest and local color to many dreary landscapes and has become a prominent figure in the literature of the West. There it is usually symbolic of shifty cunning and fleetness of foot. Whatever his faults, the coyote is an amusing and interesting beast, and it is hoped that the day of his complete disappearance from our wild life may be far in the future.

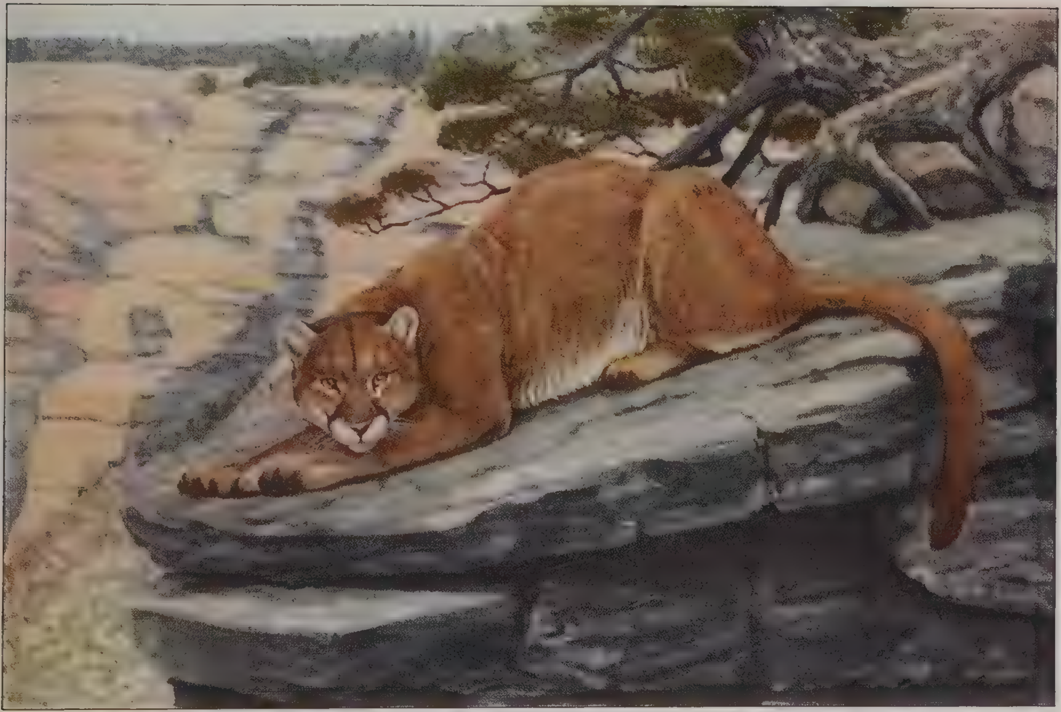
ARIZONA, OR MEARNS, COYOTE: Canis mearnsi

(*For illustration, see Color Plate, page* 79)

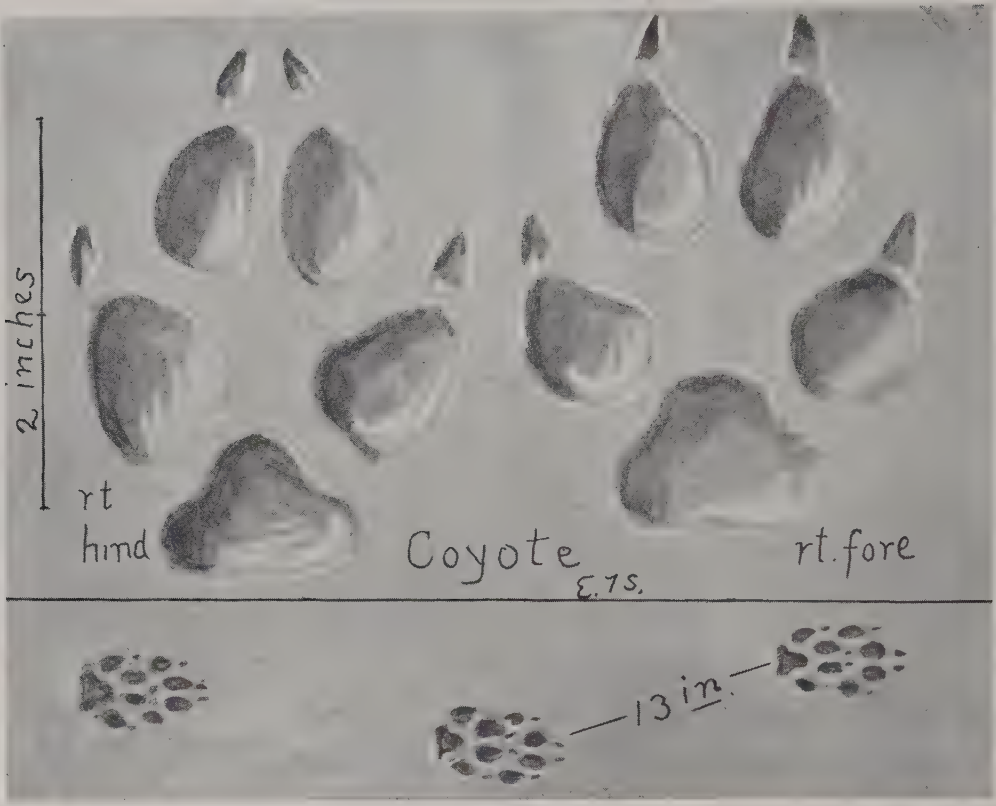
The Arizona coyote is one of the smallest and at the same time the most handsomely colored of all its kind. Its home is limited to the arid deserts on both sides of the lower Colorado River, but mainly in southwestern Arizona and adjacent parts of Sonora. This is one of the hottest and most arid regions of the continent, and for coyotes successfully to hold their own there requires the exercise


Louis Agassiz Fuertes

MEXICAN TIGER-CAT, or OCELOT
Felis pardalis



MOUNTAIN LION
Felis concolor hippolestes



A COYOTE'S TRACK CANNOT BE CLEARLY DISTINGUISHED FROM THAT OF A SMALL DOG

The greater size of the side toes in the hind track is noticeable, but there is no corresponding disproportion in the animal's foot.

of all the acute intelligence for which they are noted. Instead of the winter blizzards and biting cold encountered in the home of the plains coyote, this southern species has to endure the furnacelike heat of summer, with occasional long periods of drought, when water-holes become dry, plant life becomes dormant, and a large part of the smaller mammal life perishes.

The Arizona coyote, like others of its kind, is omnivorous. In seasons of plenty, rabbits, kangaroo rats, pocket gophers, and many other desert rodents cost only the pleasant excitement of a short stalk. With the changing seasons the flesh diet is varied by the sugary mesquite beans, juicy cactus fruit, and other products of thorny desert plants. Wherever sufficient water is available for irrigation, small communities of Indians or Mexicans are to be found. About such centers many coyotes usually establish themselves and fatten on poultry, green corn, melons, and other fruits provided by the labor of man. Many of them also patrol the shores of the Gulf of California and feast upon the eggs of turtles and other spoils of the sea.

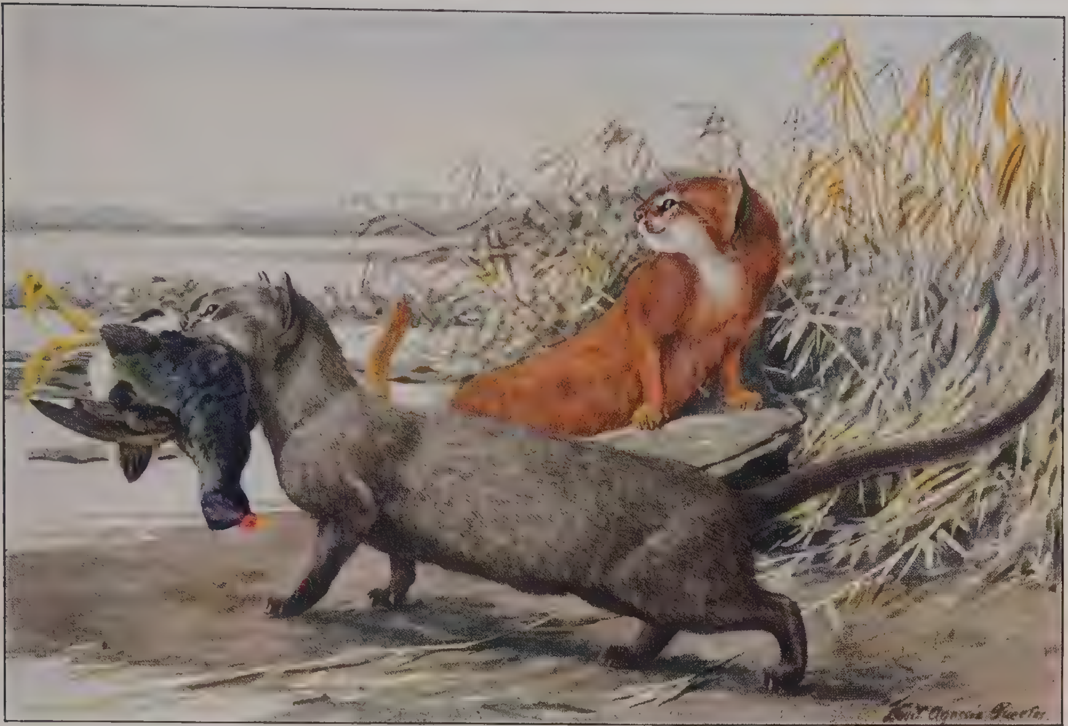
The arrival of men at a desert water-hole is quickly known among these alert foragers, and when the travelers arise at daybreak they are likely to see telltale tracks on the sand where one or two coyotes have walked in and out between their sleeping places and all about camp. Shortly afterward the campers, if inexperienced, may learn that bacon and other food are contraband and always confiscated by these dogs of the desert. These camp marauders often stand among the bushes only 75 or 100 yards away in the morning and watch the intruders with much curiosity until some hostile movement starts them off in rapid flight.

AMERICAN GRAY, OR TIMBER, WOLF: Canis lycaon and its relatives

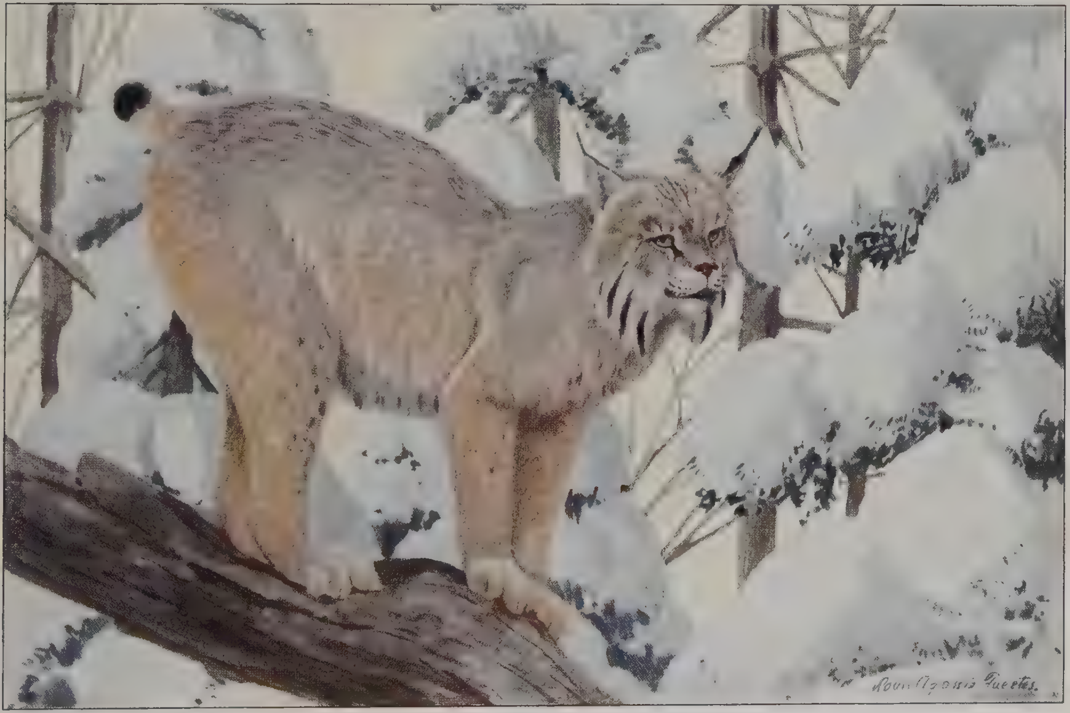
(*For illustration, see Color Plate, page* 89)

Large wolves, closely related to those of Europe and Siberia, once infested practically all of arctic and temperate North America, excepting only the arid desert Plains. This range extended from the remotest northern lands beyond 83 degrees of latitude, south to the mountains about the Valley of Mexico.

When America was first colonized by white men, wolves were numerous everywhere in proportion to the abundance of game animals.


Louis Agassiz Fuertes

JAGUARUNDI CAT, or EYRA (red and gray phases)
Herpailurus cacomitli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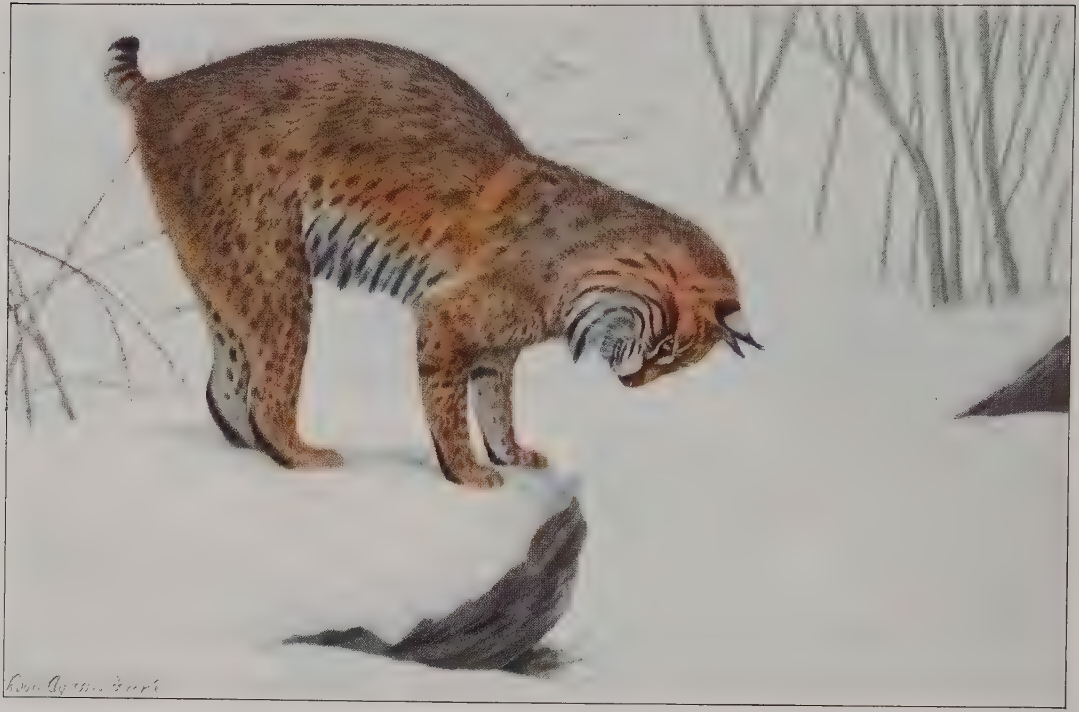
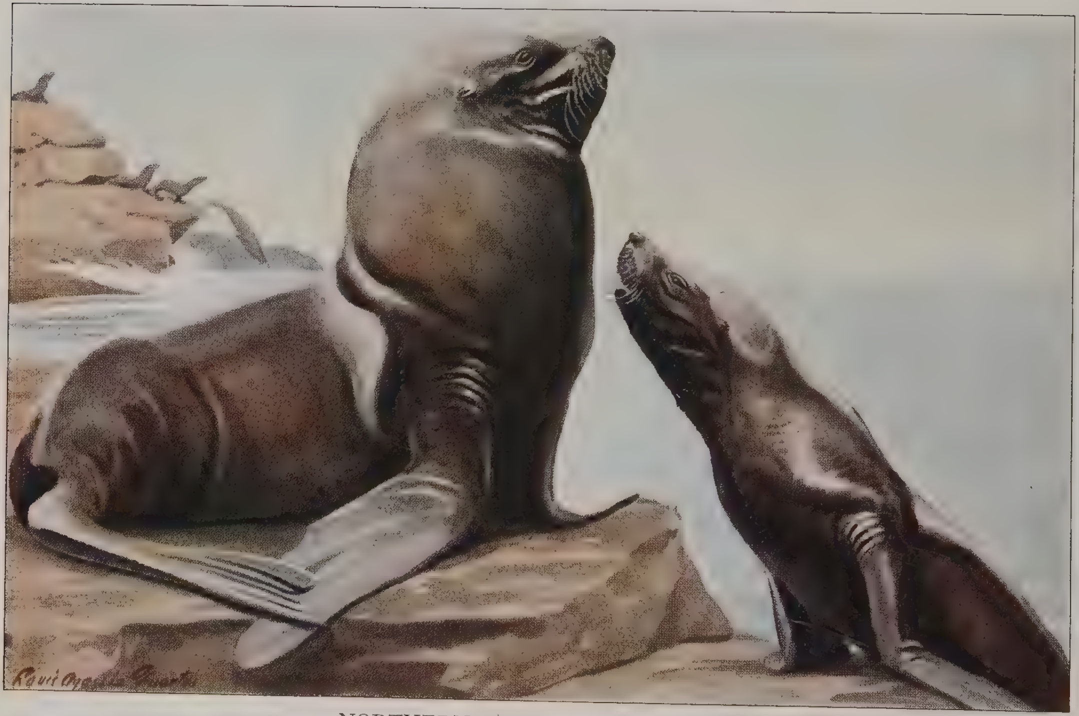
CANADA LYNX
Lynx canadensis



EASTERN BOBCAT, or BAY LYNX
Lynx rufus



NORTHERN, or STELLER SEA-LION
Eumetopias jubata

With the increased occupation of the continent and the destruction of most of its large game, wolves have entirely disappeared from large parts of their former domain. They still occur in varying numbers in the forest along our northern border from Michigan westward, and south along the Rocky Mountains and the Sierra Madre to Durango, Mexico, and also in all the Gulf States.

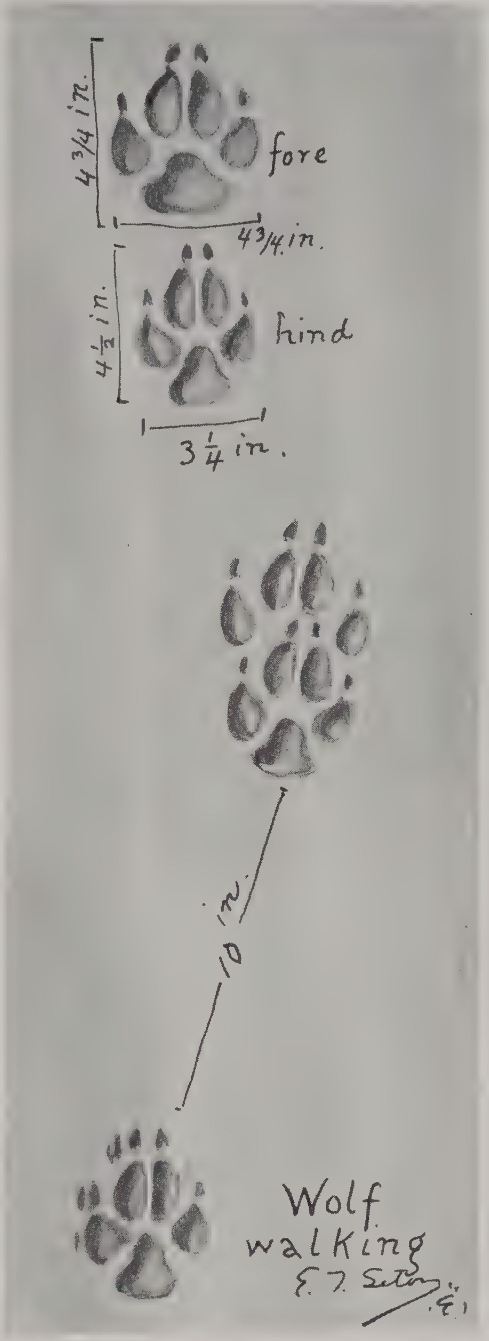
The variations in climate and other physical conditions within their range have resulted in the development of numerous geographic races which show marked difference in size and color. The white Arctic wolf, described on page 96, is one of the most notable of these, but the gray wolf of the Rocky Mountain region and the eastern United States is the best known.

Since the dawn of history Old World wolves, when hunger pressed, have not hesitated to attack men, and in wild districts have become a fearful scourge. American wolves have rarely shown this fearlessness toward man, probably owing to the abundance of game before the advent of white men and to the general use of firearms among the pioneers. That wolves are extremely difficult to exterminate is shown by their persistence to the present day in parts of France and elsewhere in Europe. This is due both to their fecundity (they have from eight to twelve young), and to their keen intelligence, which they so often pit successfully against the wiles of their chief enemy—man.

Gray wolves appear to mate permanently, and in spring their young are born in natural dens among great rocks, or in a burrow dug for the purpose in a hillside. There both parents exercise the greatest vigilance for the protection of the young. The male kills and brings in game and stands guard in the neighborhood, while the mother devotes most of her time to the pups while they are very small. At other times of the year packs made up generally of parents and the young of the preceding season hunting together with a mutual helpfulness in pursuing and bringing down their prey, show a high order of intelligence. Wolves are, in fact, first cousins of the dog, whose mental ability is recognized by all.

During the existence of the great buffalo herds, packs of big gray "buffalo wolves" roamed the Western Plains, taking toll wherever it pleased them. Since these vast game herds have disappeared, only a comparatively few of the wolves have survived. There have been enough, however, not only to commit great ravages among the deer and other game in northern Michigan and on the coastal islands of Alaska, but also to destroy much live stock in the Rocky Mountain region.

So serious have the losses in cattle and sheep on the ranges become that Congress has made large appropriations for the destruction of wolves and other predatory animals, and such disturbers of the peace are being reduced in numbers. The necessity for action of this kind is shown by the capture in Wyoming of a huge old dog wolf with a definite record of having killed about $25,000 worth of stock. Interesting as wolves are in the wilderness, their habits bar them from toleration in civilized regions.


4 3/4 in.
fore
4 3/4 in.
4 1/2 in.
hind
3 1/4 in.
10 in.
Wolf walking
E. T. Seton

A GRAY WOLF'S TRAIL

The track is that of a large animal. There is no certain way of distinguishing it from that of a dog. Size and probabilities must be considered. Formerly such tracks could be found throughout most of arctic and temperate North America, but wolves have now disappeared from large parts of their former hunting grounds.

ARCTIC WOLF: Canis tundrarum

(*For illustration, see Color Plate, page* 210)

In order to fit properly into a high northern environment, Arctic wolves have developed white coats, which they wear throughout the year. They are among the largest of their kind and have all the surpassing vigor needful for successful beasts of prey in the rigors of such a home. Nature is more than ordinarily hard on weaklings in the Far North and only the fittest survive.

The range of the white wolves covers the treeless barren grounds bordering the Arctic coast of Alaska and Canada and extending across the Arctic islands to the north coast of Greenland beyond 83 degrees of latitude.

The short summer in the Far North is the season of plenty, during which swarms of wild fowl furnish a bountiful addition to the regular food supply. Young wolves are reared and the pack feeds fat, laying up a needed reserve strength for the coming season of darkness. When winter arrives lemmings and Arctic hares and an occasional white fox furnish an uncertain food supply for such insistent hunger as that of wolves, and larger game is a necessity.

In the northern part of their range, they share with the other denizens of that land the months of continuous night. There, amid violent storms and iron frosts, the trail, once found, must be held to the end. The chase is made in the gloom of continuous night and the white caribou or musk ox herd is brought to bay, and by the law of the pack food is provided.

White wolves are the one dreaded foe Nature has given the musk ox and the caribou in the northern wilds. The number of the wolves, as with other carnivores, varies with the abundance of their chief prey, and they will disappear automatically with the caribou and musk oxen.

MEXICAN JAGUAR: Felis hernandesii
and its subspecies

(*For illustration, see Color Plate, page* 89)

The jaguar, or *tigre,* as it is generally known throughout Spanish America, is the largest and handsomest of American cats. Its size and deep-yellow color, profusely marked with black spots and rosettes, give it a close resemblance to the African leopard. It is, however, a heavier and more powerful animal. In parts of the dense tropical forests of South America, coal-black jaguars occur, and while representing merely a color phase, they are popularly supposed to be much fiercer than the ordinary animal.

Jaguars are characteristic animals of the Tropics in both Americas, frequenting alike the low jungle of arid parts as well as the great forests of the humid regions. In addition, they range south into Argentina and north into the southwestern United States. Although less numerous within our borders than formerly, they still occur as rare visitants as far north as middle Texas, middle New Mexico, and northern Arizona. They are so strictly nocturnal that their presence in our territory is usually not suspected until, after depredations on stock usually attributed to mountain lions, a trap or poison is put out and reveals a jaguar as the offender. Several have been killed in this way within our border during the last ten years, including one not far from the tourist hotel at the Grand Canyon of Arizona.

Although so large and powerful, the jaguar has none of the truculent ferocity of the African leopard. During the years I spent in its country, mainly in the open, I made careful inquiry without hearing of a single case where one had attacked human beings. So far as I could learn, it has practically the same shy and cowardly nature as the mountain lion. Despite this, the natives throughout its tropical home have a great fear of "el tigre," as I saw evidenced repeatedly in Mexico. Apparently this fear is based wholly on its strength and potential ability to harm man if it so desires.

Jaguars are very destructive to the larger game birds and mammals of their domain and to horses and cattle on ranches. On many large tropical ranches a *tigrero,* or tiger hunter, with a small pack of mongrel dogs, is maintained, whose duty it is immediately to take up the trail when a jaguar makes its presence known, usually by killing cattle. The hunter steadily continues the pursuit, sometimes for many days, until the animal is either killed or driven out of the district. It is ordinarily hunted with dogs, which noisily follow the trail, but its speed through the jungle often enables it to escape. When hard pressed it takes to a tree and is easily killed.

Few predatory animals are such wanderers as the jaguar, which roams hundreds of miles from its original home, as shown by its occasional appearance far within our borders. In the heavy tropical forest, it so commonly follows the large, wandering herds of white-lipped peccaries that some of the Mexicans contend that every large herd is trailed by a tiger to pick up stragglers. Along the Mexican coast in spring, when sea turtles crawl up the beaches to bury their eggs in the sand, the rising sun often reveals the fresh tracks of the jaguar where it has traveled for miles along the shore in search of these savory deposits.

In one locality on the Pacific coast of Guerrero I found that the hardier natives had an interesting method of hunting the jaguar during the mating period. At such times the male has the habit of leaving its lair near the head of a small canyon in the foothills early in the evening and following down the canyon for some distance, at intervals uttering a subdued roar. On moonlight nights at this time the hunter places an expert native with a short wooden trumpet near the mouth of the canyon to imitate the animal's call as soon as it is heard and to repeat the cry at proper intervals. After placing the caller, the hunter ascends the canyon several hundred yards and, gun in hand, awaits the approach of the animal. The natives have many amusing tales of the sudden exit of untried hunters when the approaching animal unexpectedly uttered its roar at close quarters.

MEXICAN TIGER-CATS, OR OCELOTS: **Felis pardalis** and its relatives

(*For illustration, see Color Plate, page* 91)

The brushy and forested areas of America from southern Texas and Arizona to Paraguay are inhabited by spotted cats of different species, varying from the size of a large house cat to that of a Canada lynx. Only one of these occurs in the United States. All are characterized by long tails and a yellowish ground color, conspicuously marked by black spots, and on neck and back by short, longitudinal stripes—a color pattern that strongly suggests the leopard.

In the lower Rio Grande Valley of Texas the tiger-cat formerly was rather common, with the eyra cat, in areas densely overgrown with thorny chaparral. Like most of the cat tribe, it is strictly nocturnal and by day lies well hidden in its brushy shelter. By night it wanders along trails over a considerable territory, seeking its prey. Birds of all kinds, including domestic poultry, are captured on their roosts, and rabbits, wood rats, and mice of many kinds, as well as snakes and other reptiles, are on its list of game.

Its reptile-eating habit was revealed to me unexpectedly one day in the dense tropical forest of Chiapas. I was riding along a steep trail beside a shallow brush-grown ravine when a tiger-cat suddenly rushed up the trunk of a tree close by. A lucky shot from my revolver brought it to the ground, and I found it lying in the ravine by the body of a recently killed boa about six or seven feet long. It had eaten the boa's head and neck when my approach interrupted the feast.

The first of these cats I trapped in Mexico was captured the night after my arrival, in a trail bordering the port of Manzanillo, on the Pacific coast. The rejoicing of the natives living close by evidenced the toll this marauder had been taking of their chickens.

The tiger-cat is much more quiet and less fierce in disposition than most felines. It excited my surprise and interest whenever I trapped one to note how nonchalantly it took the situation. The captive never dashed wildly about to escape, but when I drew near, it sat and looked quietly at me without the slightest sign of alarm and with little apparent interest. A small trap-hold, even on the end of a single toe, was enough to retain the victim. On one occasion, while a cat thus held sat looking at me, it quietly reached to one side and sank its teeth into the bark of a small tree to which the trap was attached, and then resumed its air of unconcern.

Spotted cats of one kind or another are most numerous and characteristic of the hot and humid forests from southern Mexico to South America. The extension of their range to within our borders gives an interesting touch of the Tropics and its exuberance of animal life. They are found in so small a corner of our territory, however, that, despite their mainly inoffensive habits, they are certain to be crowded out in the near future by the increased occupation of their haunts.

MOUNTAIN LION: **Felis concolor hippolestes** and its subspecies

(*For illustration, see Color Plate, page* 91)

The mountain lion, next to the jaguar, is the largest of the cat tribe native to America. In various parts of its range it is also known as the panther, cougar, and puma. It is a slender-bodied animal with a small head and a long round tail, with a total length varying from seven to nine feet and a weight from 150 to about 300 pounds in extreme instances.

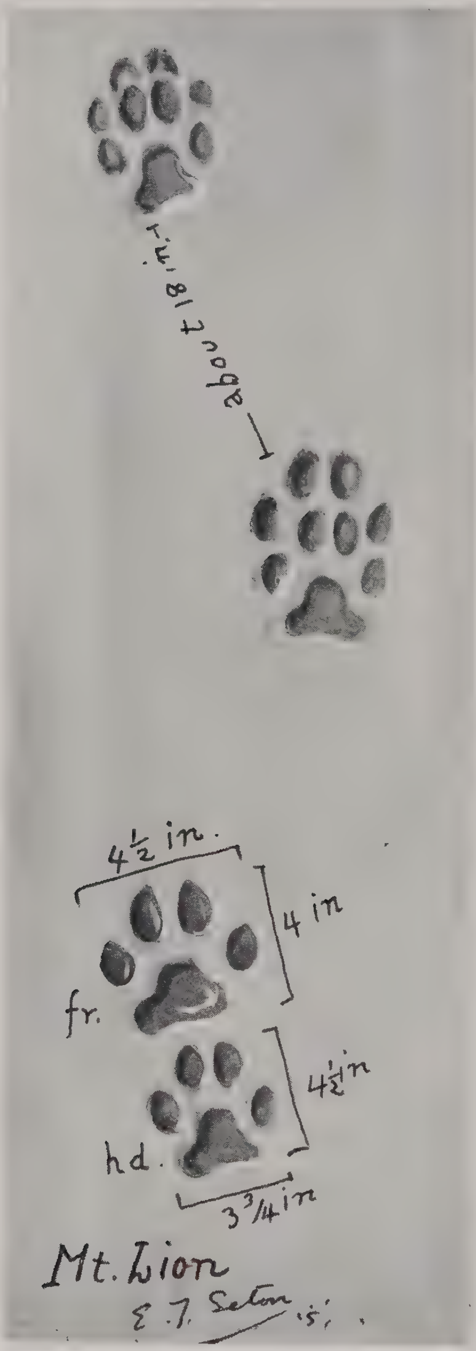
It has from two to five young, which are paler brown than the adult and plainly marked with large dusky spots on the body and with dark bars on the tail. These special markings of the young, as in other animals, are ancestral, and here appear to indicate that in the remote past our plain brown panther was a spotted cat somewhat like the leopard.

No other American mammal has a range equal to that of the mountain lion. It originally inhabited both North and South America from southern Quebec and Vancouver Island to Patagonia and from the Atlantic to the Pacific coasts. Within this enormous territory it appears to be equally at home in an extraordinary variety of conditions. Formerly it was rather common in the Adirondacks of northern New York and still lives in the high Rocky Mountains of the West, where it endures the rigors of the severest winter temperatures. It is generally distributed, where large game occurs, in the treeless ranges of the most arid parts of the southwestern deserts, and is also well known in the most humid tropical forests of Central and South America, whose gloomy depths are drenched by almost continual rain.

A number of geographic races of the species have been developed by the varied character of its haunts. These are usually characterized by differences in size and by paler and grayer shades in the arid regions and by darker and more reddish or richer brown ones in the humid areas.

The mountain lion, while powerful enough to be dangerous to man, is in reality extremely timid. Owing to its being a potentially dangerous animal, the popular conception of it is that of a fearsome beast, whose savage exploits are celebrated in the folklore of our frontier. As a matter of fact, few wild animals are less dangerous, although there are authentic accounts of wanton attacks upon people, just as there are authentic instances of buck deer and moose becoming aggressive. It has a wild, screaming cry which is thrillingly impressive when the shades of evening are throwing a mysterious gloom over the forests. In the mountains of Arizona one summer a mountain lion repeatedly passed along a series of ledges high above my cabin at dusk, uttering this loud weird cry which, as popular belief has it, really resembles the harsh scream of a terrified woman.

The mountain lion is usually nocturnal, but in regions where it is not hunted it not infrequently goes abroad by day. It is a tireless wanderer, often traveling many miles in a sin-



MOUNTAIN LION, OR COUGAR

Although this track is much larger than that of a house cat, otherwise it differs little from that shown on page 101. Sometimes, as in the cat, the hind foot is set exactly on the track of the front foot. Tracks of the mountain lion are easily recognizable anywhere except where its range is shared by the jaguar.

gle night, sometimes in search of game and again in search of new hunting grounds. I have repeatedly followed its tracks for long distances along trails, and in northern Chihuahua I once tracked one for a couple of miles from a bare rocky hill straight across the open, grassy plain toward a treeless desert mountain, for which it was heading, some eight or ten miles away.

Although inoffensive as to people, this cat is such a fierce and relentless enemy of large game and live stock that it is everywhere an outlaw. Large bounties on its head have resulted in its extermination in most parts of the eastern United States and have diminished its numbers elsewhere. It is not only hunted with gun and dog but also with trap and poison.

A mountain lion usually secures its prey by a silent, cautious stalk, taking advantage of every cover until within striking distance, and then, with one or more powerful leaps, dashing the victim to the ground with all the stunning impact of its weight. In a beautiful live-oak forest on the mountains of San Luis Potosí I once trailed one of these great cats to the spot where it had killed a deer a short time before. I could plainly read in the trail the story of the admirable skill with which it had moved from cover to cover until it reached a knoll at one side of the little glade where the deer was feeding. Then a great leap carried it to the deer's back and struck the victim to the ground with such violence that it slid ten or twelve feet across the slope. Apparently the deer had been killed on the instant.

Another trail followed through the snow in the high mountains of New Mexico led to the top of a projecting ledge from which the lion had leaped out and down more than 20 feet, landing on the back of a deer and sliding with it 50 feet or more down the snowy slope.

The mountain lion often kills calves, but is especially fond of young horses. In many range districts of the Western States and on the tableland of Mexico, owing to the depredations of this animal, it is impossible to raise horses. Unfortunately, the predatory habits of this splendid cat are such that it cannot continue to occupy the same territory as civilized man and so is destined to disappear before him, except in remote wilderness areas.

JAGUARUNDI CAT, OR EYRA: Herpailurus cacomitli and its subspecies

(*For illustration, see Color Plate, page* 93)

The eyra differs greatly in general appearance from any of our other cats, although it is one of the most characteristic of the American members of this widespread family. It is larger than an otter, with a small flattened head, long body, long tail, and short legs, thus having a distinctly otterlike form. It is characterized by two color phases—one a dull gray or dusky, and the other some shade of rusty rufous. Animals of these different colors were long supposed to represent distinct species, but it has been learned not only that color is the only difference between the two, but also that the two colors are everywhere found together, affording satisfactory evidence that they are merely color phases of the same species.

The eyra is a habitant of brush-grown or forested country, mainly in the lowlands, from the lower Rio Grande Valley of Texas south to Paraguay. In this vast territory it has developed a number of geographic races.

In southern Texas, where it is often associated with the ocelot, the eyra lives in dense thorny thickets of mesquites, acacias, ironwood, and other semitropical chaparral in a region of brilliant sunlight; but farther south it also roams the magnificent forests of the humid Tropics, in which the sun rarely penetrates. It appears to be even more nocturnal and retiring than most of our cats, and but little is known of its life history. The results of thorough trapping in the dense thorny thickets near Brownsville, Texas, indicate that it was probably more common there than is generally supposed.

The natives in the lowlands of Guerrero, on the Pacific coast of Mexico, informed me that the eyra in that region is fond of the vicinity of streams, and that it takes to the water and swims freely, crossing rivers whenever it desires. Its otterlike form goes well with such habits, and further information may prove that it is commonly a water-frequenting animal. Its unusual form and dual coloration and our lack of knowledge regarding the life of the eyra unite to make it one of the most interesting of our carnivores.

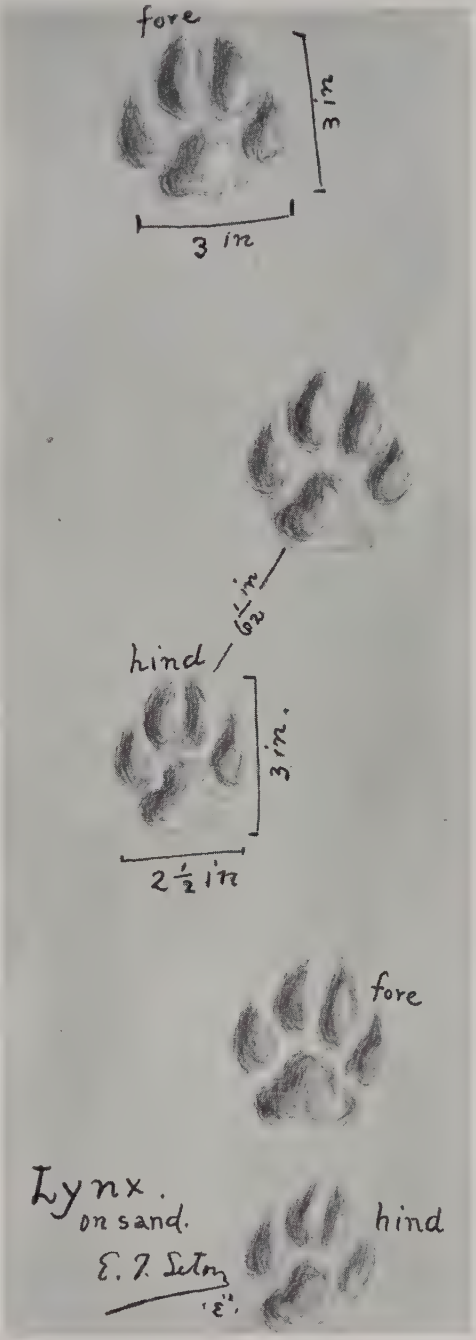
CANADA LYNX: **Lynx canadensis**

(*For illustration, see Color Plate, page* 93)

The lynxes are long-legged, short-bodied cats, with tufted ears and a short "bobbed" tail. They are distributed from the northern limit of trees south into the Temperate Zone throughout most of the northern part of both the Old and New Worlds. In North America there are two types—the smaller animal, southern in distribution, and the larger, or Canada lynx, confined to the north, where its range extends from the northern limit of trees south to the northern border of the United States. It once occupied all the mountains of New England and south in the Alleghenies to Pennsylvania. In the West it is still an inhabitant of the Rocky Mountains as far south as Colorado, and of the Sierra Nevada nearly to Mount Whitney.

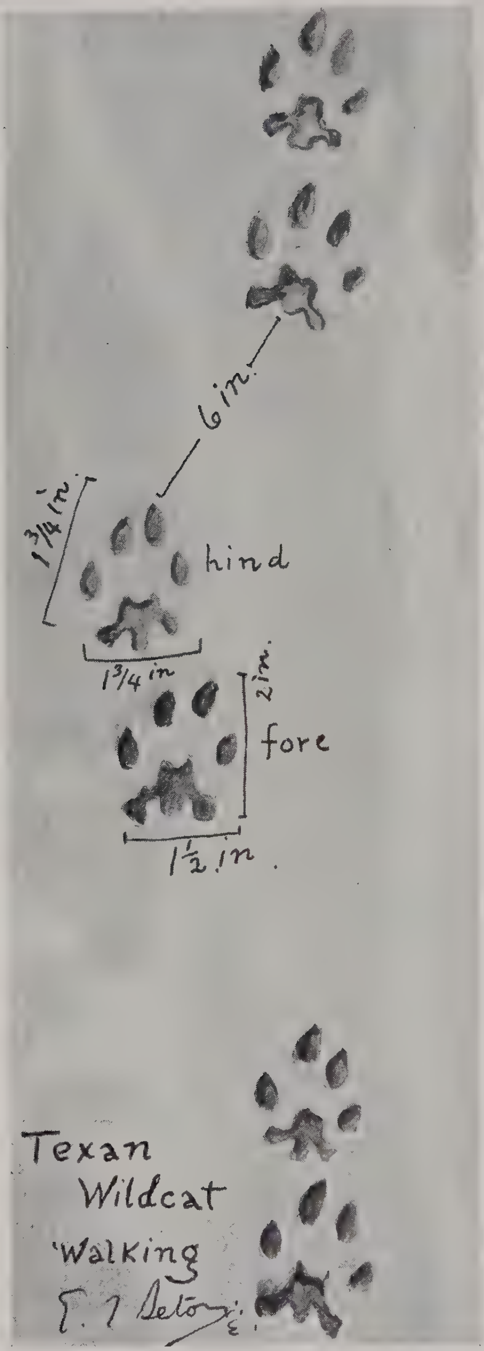
The Canada lynx is notable for the beauty of its head, one of the most striking among all our carnivores. This species is not only much larger than its southern neighbor, the bay lynx, but may also be distinguished from it by its long ear tips, thick legs, broad-spreading feet, and the complete jet-black end of the tail. It is about three feet long and weighs from 15 to over 30 pounds. As befits an animal of the great northern forests, it has a long thick coat of fur, which gives it a remarkably fluffy appearance. Its feet in winter are heavily furred above and below and are so broad that they serve admirably for support in deep snow, through which it would otherwise have to wade laboriously.

This animal does not attack people except on very rare occasions, though popular belief often



CANADA LYNX TRAIL

This track was sketched on the Athabasca River. In summer the track of a lynx shows the toe-pads faintly; in winter all are muffled in hair and the track is much larger. Lynx tracks are among the most fascinating of wild animal trails left on the snow in northern forests where they lead from thickets in search of small game.



A TEXAN WILDCAT, OR BOBCAT, TRAIL

This track, while akin to that of a cat (see page 101), has some well-marked characteristics. The complicated outline of the heel-pads is striking. The claws do not show. Bobcats often use man-made trails at night and leave the story of their passing clearly printed in the fine dust.

credits it with such action. It feeds mainly on such small prey as varying hares, mice, squirrels, foxes, and the grouse and other birds living in its domain; but on occasion it even kills animals as large as mountain sheep. One such feat was actually witnessed above timber-line in winter on a spur of Mount McKinley. The lynx sprang from a ledge as the sheep passed below, and, holding on the sheep's neck and shoulders, it reached forward and, by repeated biting, put out the victim's eyes, thus reducing it to helplessness.

The chief food of the Canada lynx is the varying hare, which throughout the North periodically increases to exceeding abundance and holds its numbers for several years. During these periods the fur sales in the London market show that the number of lynx skins received increases proportionately with those of the hare. When an epizoötic disease appears, as it does regularly, and almost exterminates the hares, there is an immediate and corresponding drop in the number of lynx skins sent to market. This evidences one of Nature's great tragedies, not only among the overabundant hares, but among the lynxes and some other predators of those regions, for with the failure of their food supply over a vast area tens of thousands of them perish of starvation.

The Canada lynx has from two to five kittens, which are marked with dusky spots and short bands, indicating an ancestral relationship to animals similar to the ocelot, or tiger-cat, of the American Tropics. The young usually keep with the mother for nearly a year. Such families no doubt form the hunting parties whose rabbit drives on the Yukon islands were described to me by the fur traders and Indians of the Yukon Valley.

During sledge trips along the lower Yukon I often saw the distinctive broad, rounded tracks of lynxes, showing where they had wandered through the forests or crossed the wide, snow-covered river channel. Here and there, as the snow became very deep and soft, the tracks showed where a series of leaps had been made. Lynx trails commonly led from thicket to thicket where hares, grouse, or other game might occur. Canada lynxes appear to be rather stupid animals, for they are readily caught in traps, or even in snares, and, like most cats, make little effort to escape.

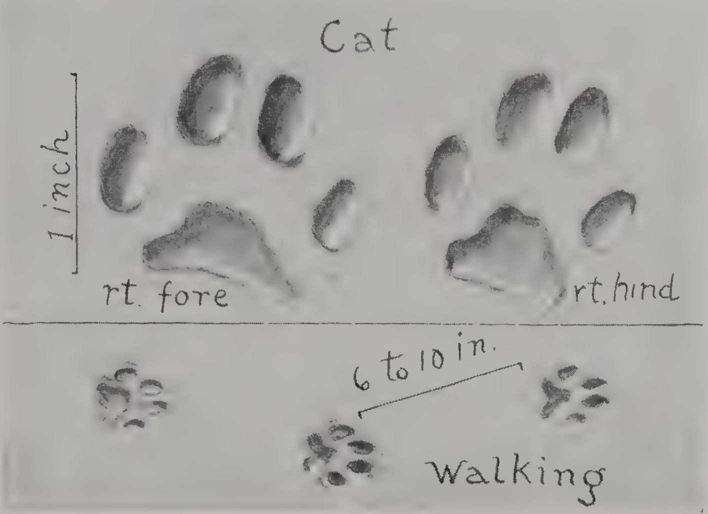
EASTERN BOBCAT, OR BAY LYNX:
Lynx rufus and its subspecies

(For illustration, see Color Plate, page 94)

The bay lynx, bobcat, or wildcat, as *Lynx rufus* and its close relatives are variously called in different parts of the United States, is one of the most widely distributed and best known of our wild animals. It is about two-thirds the size of the Canada lynx and characterized by much slenderer proportions, especially in its legs and feet. The ears are less conspicuously tufted and the tip of the tail is black only on its upper half. Bobcats range from Nova Scotia and southern British Columbia over practically all of the wooded and brushy parts of the United

States except along the northern border, and extend south to the southern end of the high table-land of Mexico.

From the earliest settlement of America, the bobcat has figured largely in hunting literature, and the popular estimate of its character is well attested by the frontier idea of the superlative physical prowess of a man who can "whip his weight in wildcats." Although our wildcat usually weighs less than 20 pounds, if its reputed fierceness could be sustained it would be an awkward foe. But, so far as man is concerned, unless it is cornered and forced to defend itself, it is extremely timid and inoffensive.



A QUADRUPED WITH BIPED TRACK: THE COMMON CAT

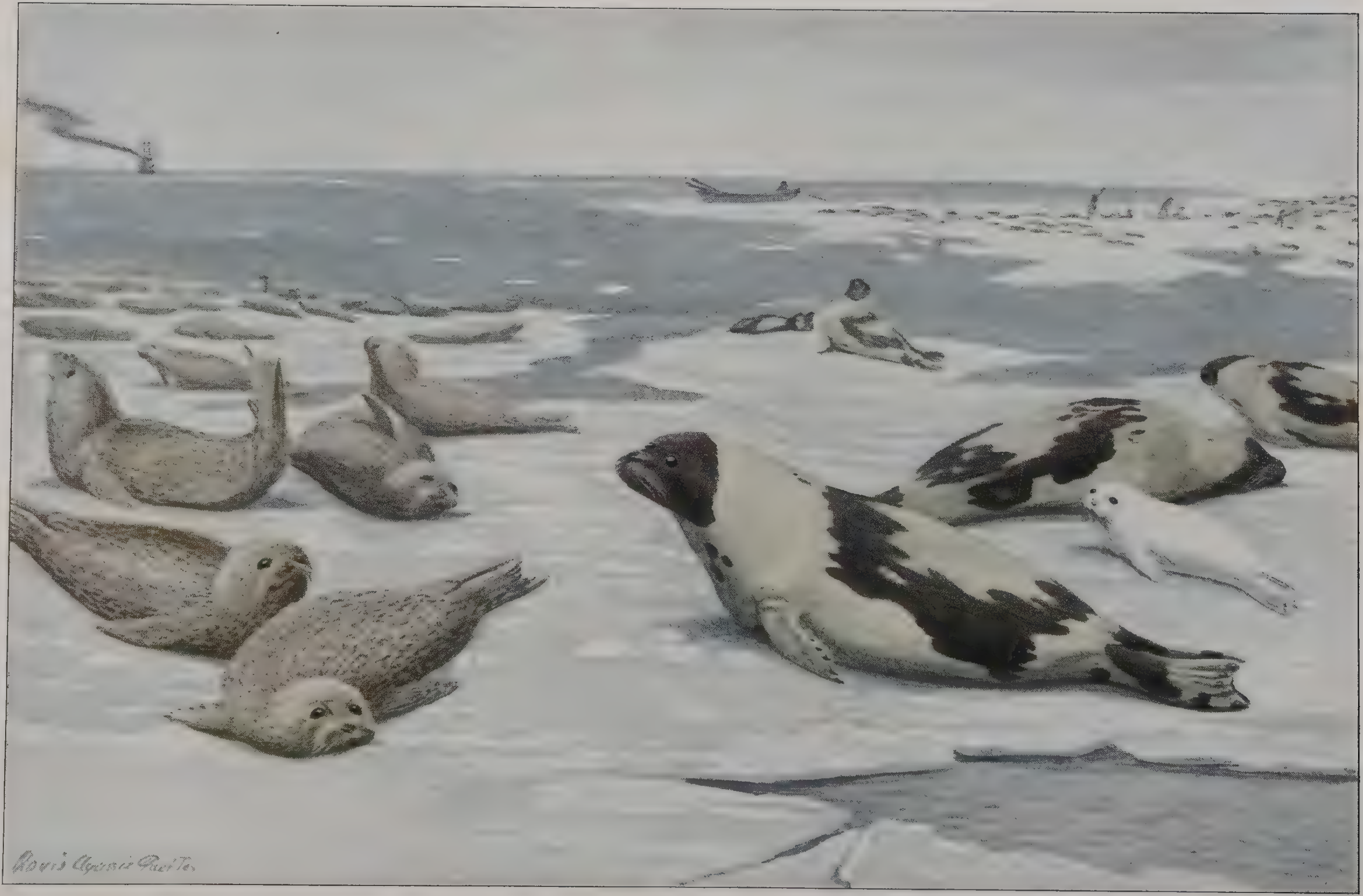
The cat does not show its claws in the track. In walking, the hind foot is set exactly in the track of the front foot; this perfect register offers many advantages and makes for a silent tread. The track of the cat will probably be noticed more than that of any other animal, because of the large numbers of them in every locality.

Like all cats, it is very muscular and active, and to the rabbits, squirrels, mice, grouse, and other small game upon which it feeds it is a persistent and remorseless enemy. Although an expert tree-climber, it spends most of its time on the ground, where it ordinarily seeks its prey. It is most numerous in districts where birds and small mammals abound, and parts of California seem especially favorable for it. At a mountain ranch in the redwood forest south of San Francisco one winter some boys with dogs killed more than eighty bobcats.

Ordinarily the bobcat seems to be rather uncommon, but its nocturnal habits usually prevent its real numbers being actually known. In districts where not much hunted it is not uncommonly seen abroad by day, especially in winter, when driven by hunger.

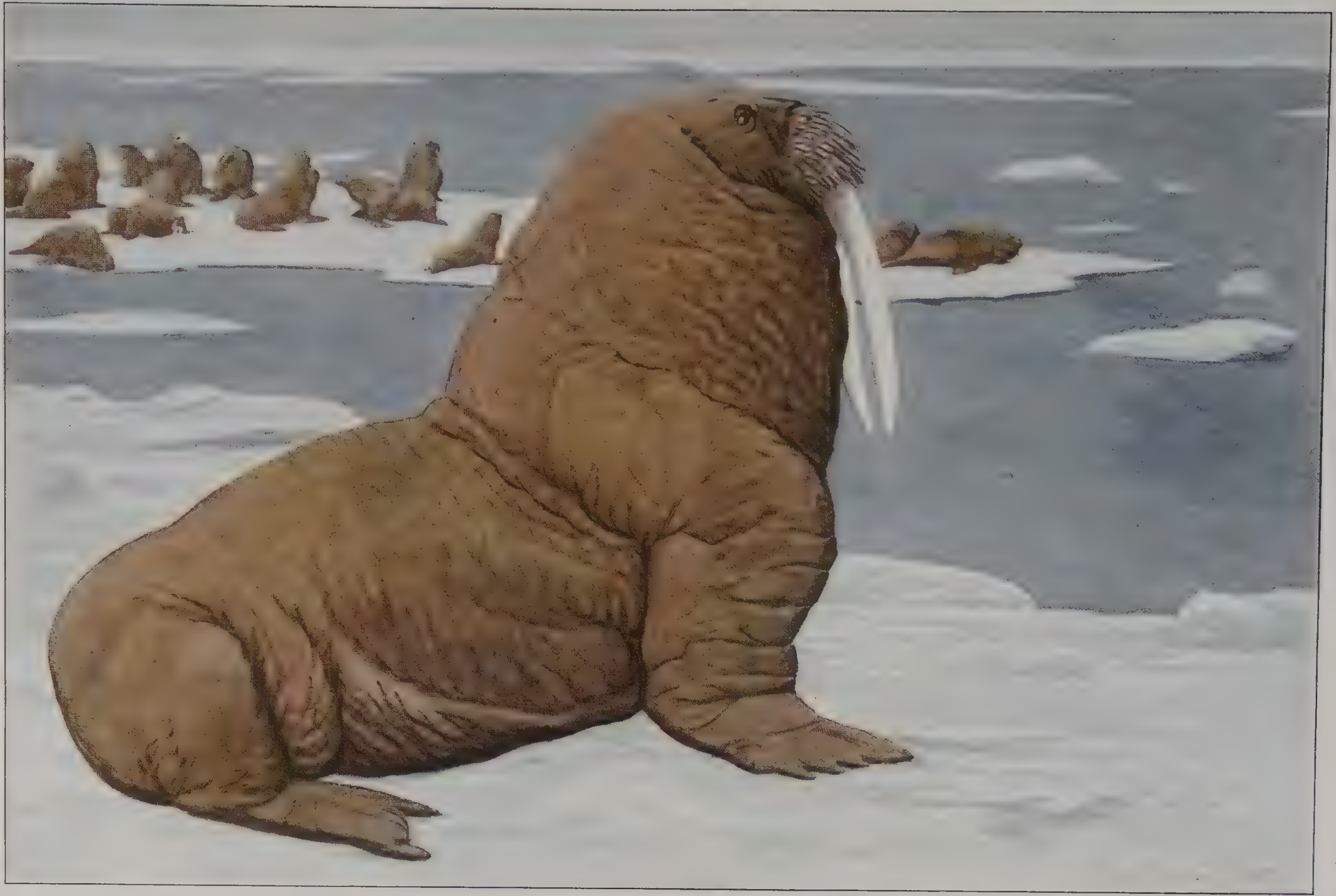
The bay lynx makes its den in hollows in trees, in small caves, and in openings among rock piles wherever quiet and safety appear assured. Although a shy animal, it persists in settled regions if sufficient woodland or broken country remains to give it shelter. From such retreats it sallies forth at night, and not only do the chicken roosts suffer, but toll is even taken among the lambs of sheep herds.

As in the case of most small cats, the stealthy hunting habits of the bay lynx render it excessively destructive to ground-frequenting birds, especially to quail, grouse, and other game birds. For this reason, like many of its kind, it is outlawed in all settled parts of the country.

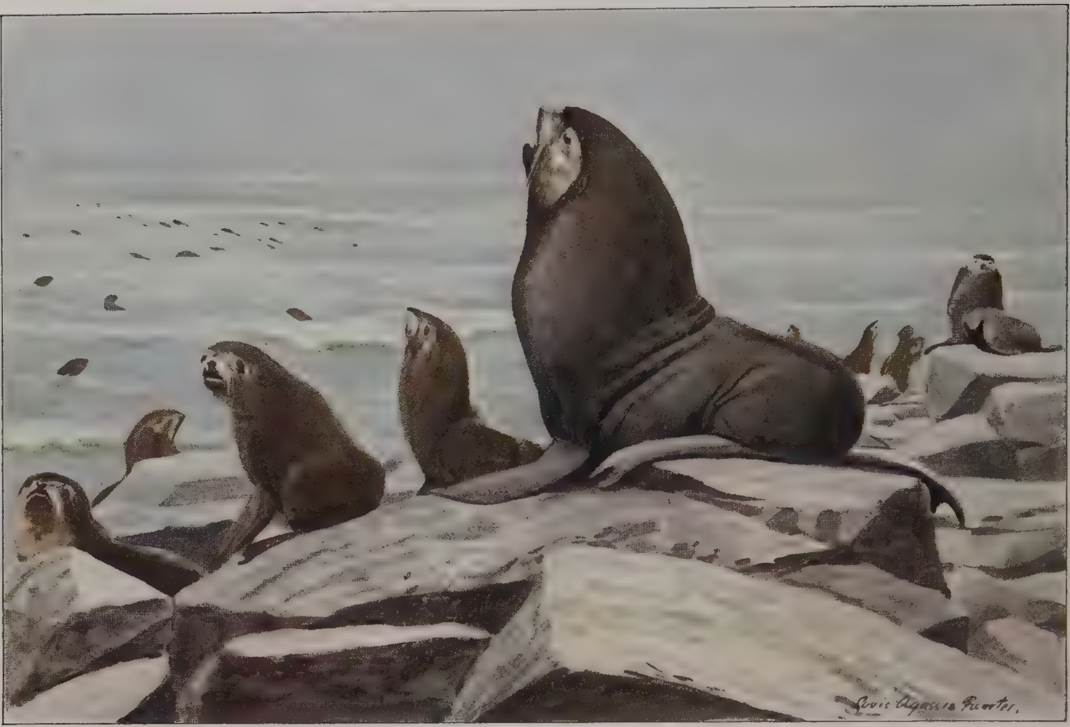

Louis Agassiz Fuertes

HARBOR SEAL, or LEOPARD SEAL
Phoca vitulina

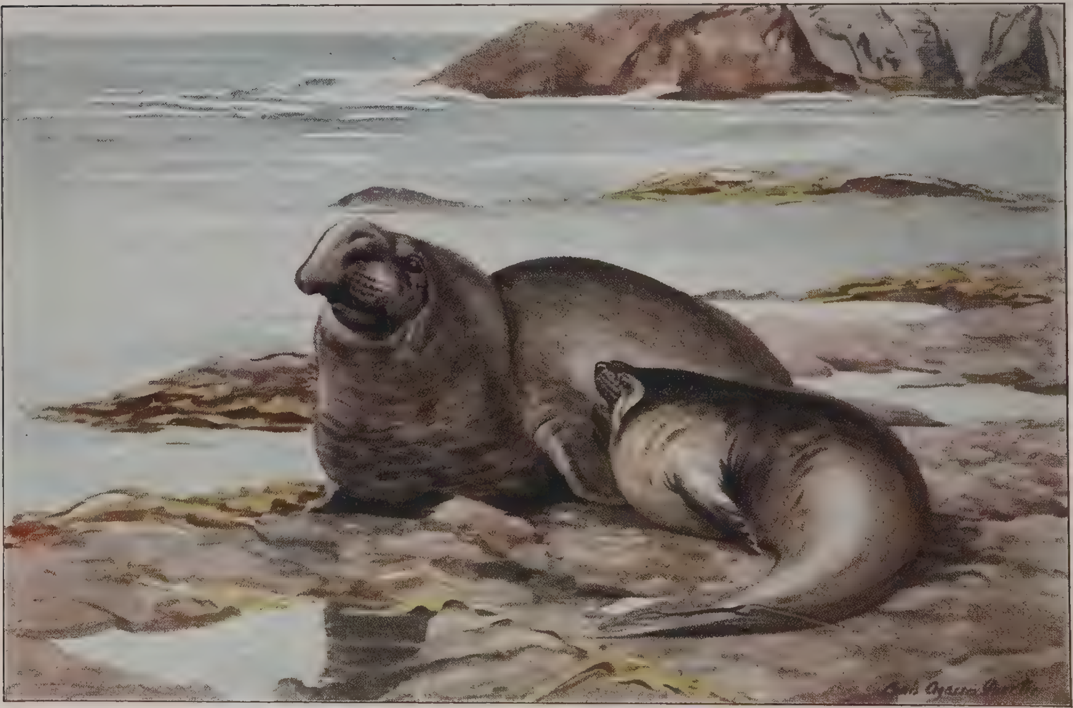
HARP SEAL, SADDLE-BACK, or GREENLAND SEAL
Phoca grœnlandica



PACIFIC WALRUS
Odobenus divergens



ALASKA FUR SEAL
Callorhinus alascanus



NORTHERN SEA-ELEPHANT, or ELEPHANT SEAL
Mirounga angustirostris

CHAPTER VI

Fur-bearing and Other Seals, and Walrus

THE seals and walruses of the Order *Pinnipedia* are closely related to the carnivores, but are greatly modified to fit them for an aquatic life, and to feed upon fish and other food available in the salt or fresh waters they inhabit. Representatives of both groups in this order occur on the Atlantic, Pacific, and Arctic coasts of North America. The members show striking differences, as illustrated by the walrus, the elephant seal, and the fur seal, but have a greater general likeness of form than that shown by most other orders.

Walruses occur only in high northern circumpolar waters, but seals inhabit all seas and are vastly more numerous in circumpolar areas, both north and south, where the borders of the ice pack and bleak, rocky islands are their favorite breeding grounds.

VALUABLE SPECIES RELENTLESSLY PURSUED BY MAN

Because of the value of their skins for fur or leather, and their blubber for oil, these animals have suffered such relentless pursuit by man that several species once existing in millions have been reduced to the very border of, if not actual, extinction.

Eared seals, of the Family *Otariidæ,* differ from all other seals in the possession of small, but distinctly projecting ears, and the possession of long front and hind flippers modified to enable them to walk, in a waddling gait, on land. The group includes the fur seals and sea-lions which occur on the coasts and islands of northern and southern seas. They are not found in the North Atlantic, but occur on both eastern and western coasts of the North Pacific and Bering Sea. In the Far South they are known from southern South America, South Africa, Australia, and many bleak far-southern islands.

The huge Northern, or Steller sea-lion, Genus *Eumetopias,* of the North Pacific and Bering Sea is the largest of the sea-lions, the old males sometimes almost equaling a walrus in bulk.

The Northern fur seals of the Genus *Callorhinus* differ in some characters from those of far-southern waters. Nearly all the survivors of the millions of these animals which once swarmed along the Pacific coast of North America now breed on the Pribilof Islands, in Bering Sea, and continue to exist under guardianship of the Government of the United States by an international treaty.

Hair seals of the Family *Phocidæ* are all characterized by the absence of external ears, by their short necks, and by the extreme modification of their hind flippers for existence in the water. On land, where the hind flippers cannot be used, the animals move by caterpillarlike contractions and extensions of the body, aided by the front flippers.

These mammals occur in the waters of practically all parts of the world, including the Caspian and Aral Seas, Lake Baikal, and far up some rivers. Typical seals belong to the Genus *Phoca.* Members of this group are the most generally distributed of the seals and are divided into many species. Among them a number occur along the coasts of North America, including the harbor seals, harp seals, and ribbon seals.

A PROBOSCIS DISTINGUISHES THE ELEPHANT SEAL

Sea-elephants, or elephant seals, of the Genus *Mirounga* are the largest and among the most remarkable of the seals. Two species are known, one from islands on the borders of the Antarctic Ocean, and the other inhabiting the coast and islands of southern and Lower California. Their proboscislike snout, from which their name is derived, is one of their outstanding characteristics.

The strange sea animals known as the walruses (Family *Odobenidæ*), wearing great downward-projecting tusks of ivory in their upper jaws, are peculiar to the Arctic regions.

Only two, closely similar, species of walrus, forming the Genus *Odobenus,* are known. One lives in the far North Atlantic and the southern Arctic Ocean from Greenland and the islands north of Europe. The other inhabits Bering Sea and the Arctic Ocean north of Bering Strait, along the shores of Alaska and eastern Siberia.

NORTHERN, OR STELLER SEA-LION: Eumetopias jubata

(*For illustration, see Color Plate, page* 94)

Sea-lions are near relatives of the fur seals and have a nearly similar distribution, both in far-southern and northern seas. The males of the several species are more than twice the size of the females and are characterized by an enormous development of neck and shoulders. The Stellar sea-lion is the largest member of the group, the old bulls weighing from 1,200 to 1,500 pounds. All are extremely gregarious and polygamous.

The Steller sea-lions belong to the North Pacific, whence they range in winter as far south as the coasts of California and Japan. In spring they migrate northward to their breeding grounds among the Aleutian, Pribilof, and other rocky islands of the North Pacific. The early histories of this region record their great abundance, including several hundred thousand which were reported to have congregated to breed each season on the Pribilof Islands. Although less valuable than the fur seal, persistent hunting has gradually reduced their numbers on these islands until only comparatively few remain.

In summer range they are less limited than the fur seals, occurring in herds about the shores of many rocky islands off the mainland of the North Pacific and the Aleutian chain.

Since the primitive days before the arrival of civilized men in their haunts, sea-lions were of the greatest economic importance to the Aleutian Islanders and other coast natives. Food and fuel were obtained from their flesh and blubber; coverings for boats were made of their skins; waterproof overshirts of their intestines; boot soles from the skin of their flippers; trimmings of garments from their gullets and bristles, and thread from their sinews.

They are preëminently animals of the most rugged of shorelines and the stormiest of seas, being superbly powerful beasts with extraordinary vitality. The ease with which they pass through a smother of pounding seas to mount their rugged resting places is an admirable exhibition of skill and strength. The males have a bellowing roar, which rises continually from the herds on the rocks in savage unison with the booming of the sea against their refuge.

The harems of the bulls on the Pribilof Islands rarely exceed a dozen members, which are under less strict discipline than the harems of the fur seals. The old bulls, especially during the mating season, are aggressive and savage fighters, inflicting severe wounds on one another. At all times they are more courageous and belligerent than fur seals, and hunters driving parties of them back from the beach on the Pribilofs approach them with extreme caution, to avoid the dangerous charges of angry bulls. It is reported that an umbrella opened and closed suddenly in the faces of the old sea-lions appears to terrify them more than any other weapon and is used successfully in drives. At sea they have only a single known enemy to fear—the fierce killer whale.

ALASKA FUR SEAL: Callorhinus alascanus

(*For illustration, see Color Plate, page* 104)

Several species of fur seals are known, all of them limited to the southern oceans or the coasts and islands of the North Pacific. All are strongly gregarious and formerly sought their island breeding grounds in vast numbers. At one period, soon after the purchase of Alaska, it was estimated that several million fur seals were on the Pribilof Islands in one season. During the height of their abundance the Southern fur seals were equally numerous.

The value of their skins and the facility with which these animals may be slaughtered have resulted in the practical extermination of all but those which breed under governmental protection on the islands off the coast of Kamchatka and on the Pribilof Islands in Alaska. Owing mainly to wasteful pelagic sealing prior to the international treaty, the numbers on both these groups of islands were much reduced.

The Alaska fur seal is a migratory species, wintering down the Pacific coast as far as northern California. The migrations of these seals are of remarkable interest. In spring they leave the northwest coast and many of them travel steadily across more than 2,000 miles of the North Pacific. For days at a time they swim through a roaring gale-swept sea, under dense, low-hanging clouds. Finally, with unerring certainty, they strike certain passages in the Aleutian Islands, through which they press to their breeding grounds, more than 100 miles beyond, on the small, fog-hidden Pribilofs.

Fur seals are extremely polygamous and the old males, which weigh from 400 to 500 pounds, "haul up" first on the breeding beaches. Each bull holds a certain area, and as the females, only one-fifth his size, come ashore, they are appropriated by the nearest bulls until each "beach master" gathers a harem, sometimes containing more than 100 members.

Here the young are born, and after the mating season the seals, which have remained ashore without food from four to six weeks, return to the water. The mothers go and come, and each is able to find her young with certainty among thousands of apparently identical woolly black "pups."

From the ages of one to four years fur seals are extremely playful. They are marvelous swimmers and frolic about in pursuit of one another, now diving deep and then, one after the other, suddenly leaping high above the surface in graceful curves, like porpoises. Squids and fish of various species are their main food. Their chief natural enemy is the killer whale, which follows their migrations and haunts the sea about their breeding grounds.

Since the discovery of the Pribilof Islands by the Russians, the fur-seal herds there have yielded more than 5,000,000 recorded skins. A census of the herds gave these islands a population of 971,527 in 1929, and of more than 1,045,000 in 1930. Now that pelagic sealing has been suppressed and the herds are being protected, there is every reason to expect that the seals will continue to increase.

HARBOR SEAL, OR LEOPARD SEAL: Phoca vitulina

(*For illustration, see Color Plate, page* 102)

The harbor seal, one of the smallest of the hair seals, attaining a length of only five or six feet, is one of the best known of its kind. It is a species of the North Atlantic, formerly ranging well south on the European coast and to the Carolinas on the American side, though now more restricted in its southern extension. In the North Pacific, Bering Sea, and the Arctic it is represented by a closely related species (*Phoca richardii*), which ranges south to the coast of Japan on the Asiatic side and to Lower California on the American side.

Throughout their range the harbor seals haunt the coast-line, frequenting rocky points, islets, bays, harbors, and the lower courses of rivers. They commonly frequent the sandy bars exposed at low tide about the mouths of rivers, and have been known to ascend the St. Lawrence to Lake Champlain and Lake Ontario, and the Yukon to several hundred miles above its mouth. They are still common and well-known animals on the coast of Maine and eastern Canada and about many harbors on the Pacific coast. They appear to be nonmigratory species and in far-northern waters they frequent the pack ice alongshore in winter. Where the pack is unbroken, they make breathing holes through the ice, which they visit at intervals, and where they are hunted by the Eskimos.

The harbor seal is polygamous but does not form harems. Nor is it gregarious, as is the Greenland seal. That it has social instinct is evident, however, since it commonly gathers in small herds on the same sand spits, rocky points, and islets. The young are born in spring and at first are entirely covered with a woolly white coat. The mother is devoted to the "pup" and shows the deepest anxiety if danger threatens.

In Alaska the flesh and blubber of the species of harbor seal found there are highly prized by the Eskimos as the most palatable of all the seals, and the skin is valued for clothing and for making strong rawhide lines used for nets and other purposes. On the Alaskan coast of Bering Sea in fall the Eskimos capture many seals in nets set off rocky points, just as gill nets are set in the same places in spring for salmon.

Owing to the presence of the harbor seal of the Atlantic along so many inhabited coasts, much has been written concerning its habits, especially as observed about the shores of the British Isles. Where not disturbed, it shows little fear and will swim about boats or ships, raising its head high out of water, gazing steadily with large, intelligent eyes at the object of its curiosity; but when hunted it becomes exceedingly shy and wary. All who have held the harbor seal in captivity agree in praising its intelligence. It becomes very docile, often learning a variety of amusing tricks, and develops great affection for its keeper.

The small size of this seal and its limited numbers tend to save it from extensive commercial hunting and may preserve it far into the future.

RIBBON SEAL: Phoca fasciata

(*For illustration, see Color Plate, page* 40)

The broad-banded markings of the male ribbon seal render it the handsomest of the group of hair-seals to which it belongs. Its size is about that of the harbor seals and its range extends from the Aleutian Islands, on the coast of Alaska, and from the Kurils, on the Asiatic shore of the Pacific, north to Bering Strait.

This seal is so scarce and its home is in such remote and little-frequented waters that its habits are almost unknown. Apparently it is even less gregarious than the harbor seal and usually occurs singly, although a few may be seen together, where individuals chance to meet.

The few individuals taken by the Alaskan Eskimos are captured while they are hunting other seals on the pack ice in winter, and while at sea in kayaks in spring and fall. Because of its attractive markings, the skin of the male is greatly prized by the Eskimos, as it was formerly by the fur traders, for use as a clothes-bag. The skin is removed entire and then tanned, the only opening left being a long slit in the abdomen, which is provided with eyelet holes and a lacing string, thus making a convenient waterproof bag to use in boat or dog-sledge trips.

The scarcity of the ribbon seal and its solitary habits will help safeguard it from the destructive pursuit.

HARP SEAL, SADDLE-BACK, OR GREENLAND SEAL: Phoca grœnlandica

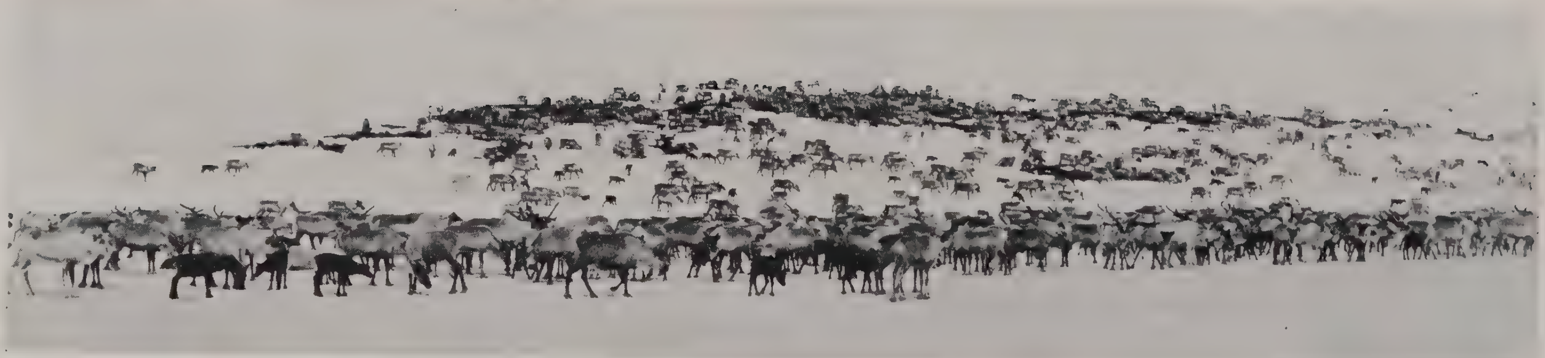
(*For illustration, see Color Plate, page* 102)

The black head, gray body, and large dorsal ring of the male harp seal are strongly distinctive markings in a group generally characterized by plain dull colors. The harp seal is a large species, the old males weighing from 600 to 800 pounds.

It is nearly circumpolar in distribution, but its area of greatest abundance extends from the Gulf of St. Lawrence to Greenland, and thence eastward in that part of the Arctic Ocean lying north of Europe and western Siberia. It is an offshore species, migrating southward with the ice pack in fall to the coast of Newfoundland and returning northward with the pack after the breeding season in spring. For a day or two during the fall migration, when these seals are passing certain points on the coast of Labrador, the sea is thickly dotted with their heads as far as the eye can reach, all moving southward.

Harp seals gather on the pack ice well offshore during March and April to breed. The main breeding grounds are off Newfoundland and off Jan Mayen Island. During the breeding season, in the days of their abundance, they gathered in enormous, closely packed herds sometimes containing several hundred thousand animals.

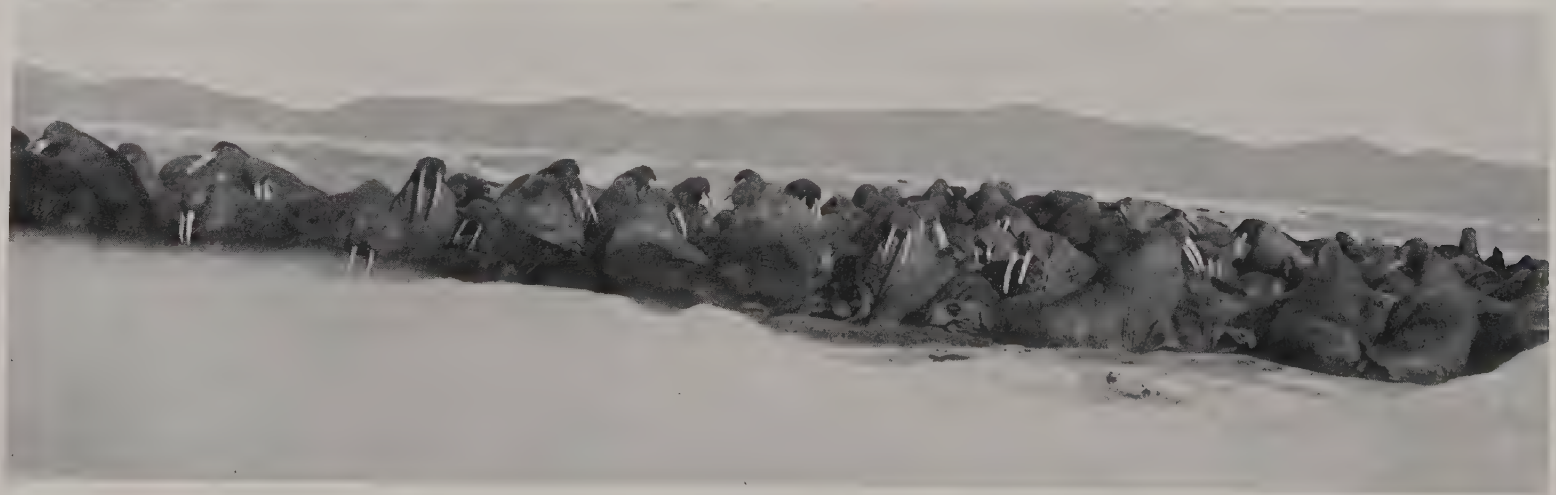
Originally there were millions of these animals in the North Atlantic and Arctic Oceans. Their gregarious habits made them an easy prey,



Photograph by Carl J. Lomen

MANY FAWNS ARE TO BE SEEN IN THIS REINDEER HERD AT CAPE PRINCE OF WALES, ALASKA

These animals were introduced into Alaska from Siberia during the last decade of the 19th century and have increased at a marvelous rate. They now number far above 500,000, and more than half of them are owned by the Eskimos, for whose special benefit they were brought over.



Photograph by E. E. Kleinschmidt

A WALRUS HERD ON THE ICE PACK

During the summer, in the Arctic Ocean north of Bering Strait, thousands of walrus haul up and lie sleeping along the front of the ice pack, where the commercial hunters, with high-powered rifles, kill great numbers of them. While their long ivory tusks and large size give these animals a formidable appearance, they are really very inoffensive.

Photograph by Roy Chapman Andrews

FUR SEAL MOTHERS AND THEIR PUPS

From the ages of one to four years, fur seals are extremely playful. They are marvelous swimmers, and frolic about in pursuit of one another, now diving deep, and then, one after the other, suddenly leaping high above the surface in graceful curves, like porpoises.

and the value of their skins and blubber formed the basis for a great industry. Hundreds of vessels were sent out from north European and American ports and nearly 1,000,000 harp seals were killed during each breeding season. This tremendous slaughter resulted in the disappearance of these seals from many of their former haunts. Some are still killed off the coast of Newfoundland, but the sealing industry is now insignificant as compared with its former estate. Now that sealers are using airplanes to locate the herds on the ice, the end of these animals as a natural resource appears near at hand.

Off Newfoundland the young harp seal is born early in March, wearing a woolly white coat. At first it is tenderly cared for by its mother, but before the end of April it has learned to swim and is left to care for itself. The young do not enter the water until they are nearly two weeks old and require several days of practice before they learn to swim well.

NORTHERN SEA-ELEPHANT, OR ELEPHANT SEAL: Mirounga angustirostris

(For illustration, see Color Plate, page 104)

Sea-elephants are the largest and among the most remarkable of the seals. Two species are known—one from islands on the borders of the Antarctic Ocean and the other from the Pacific coast of upper and Lower California. The Northern species formerly existed in vast numbers along the coast and among outlying islands from Point Reyes, north of San Francisco, south to Cedros Island, but is now reduced to a single small herd living about Guadalupe Island, off Lower California.

The old males attain a length of 22 feet or more, and are huge, ungainly beasts, moving with difficulty on land, but with ease and grace in the water. The name sea-elephant is obviously derived from the broad, flexible snout of the males, which, when relaxed, hangs six or eight inches below the muzzle.

The breeding season extends from February to June, and during this period these seals are far more numerous on shore than at any other time. They are gregarious in habits and formerly hauled up in herds on the islands or on remote and inaccessible beaches of the mainland. On shore they are sluggish, having none of the alertness shown by many other seals. They lie supine on the sand and permit a man to walk quietly up and touch them without showing signs of fear. When attacked by sealers or otherwise alarmed, however, they become panic-stricken and make ungainly efforts to escape, but quickly become exhausted. Their only natural enemy appears to be the killer whale.

Between 1855 and 1870 the great numbers of Northern sea-elephants, combined with their helplessness on shore and the value of their oil, attracted numerous sealing and whaling ships to the coast of Lower California. The resulting slaughter reduced these animals from swarming abundance to a few scattered herds. Since then their numbers have steadily decreased. The Mexican Government is now making laudable efforts to protect the small remaining herd.

PACIFIC WALRUS: Odobenus divergens

(For illustration, see Color Plate, page 103)

The walruses, or "sea horses" of the old navigators, are the strangest and most grotesque of all sea mammals. Their large, rugged heads, armed with two long ivory tusks, and their huge, swollen bodies, covered with hairless, wrinkled, and warty skin, give them a formidable appearance. They are much larger than most seals, the old males weighing from 2,000 to 3,000 pounds and the females about two-thirds as much.

These strange beasts are confined to the Arctic Ocean and the adjacent coasts and islands and are most numerous about the borders of the pack ice. Two species are known, one belonging to the Greenland seas, while the other, the Pacific walrus, is limited to Bering Sea and the Arctic basin beyond Bering Strait.

The Pacific walrus migrates southward through Bering Strait with the pack ice in fall and spends the winter in Bering Sea and along the adjacent coast of eastern Asia. In spring it returns northward through the strait and passes the breeding season about the ice pack, where it congregates in great herds. One night in July, 1881, the U. S. steamer *Corwin* cruised for hours along the edge of the ice pack off the Arctic coast of Alaska and we saw an almost unbroken line of tens of thousands of walruses hauled out on the ice.

Walruses were formerly very abundant in Bering Sea, especially about the Pribilof Islands and from the north coast of the Peninsula of Alaska north to Nunivak Island, but few, if any, now survive there.

Because of the value of their thick skins, blubber, and ivory tusks, they have been subjected to remorseless pursuit and have, as a result, become extinct in parts of their former range. The species is in serious danger of extermination.

Like many of the seals, walruses have a strong social instinct, and are usually seen in herds. Although the males are polygamous, they do not gather harems. They feed mainly on clams or other shellfish, which they gather on the bottom of the shallow sea. On shore or on the ice they move slowly and with much difficulty, but in the water they are thoroughly at home and good swimmers. When hauled out on land or ice, they usually lie in groups one against the other. They are stupid beasts and hunters have no difficulty in killing them at close range.

Walruses have a strongly developed maternal instinct and show great devotion and disregard of their own safety in defending the young. The Eskimos at Cape Vancouver, Bering Sea, hunt them in frail skin-covered kayaks, using ivory- or bone-pointed spears and sealskin floats. Several hunters told me of exciting and dangerous encounters they had experienced with mother walruses. If the young are attacked, or even approached, the mother does not hesitate to charge furiously. The hunters confess that on such occasions there is no option but to paddle for their lives. Occasionally an old walrus is unusually vindictive and, after forcing a hunter to take refuge on the ice, will remain patrolling the vicinity for a long time, roaring and menacing the object of her anger.

CHAPTER VII

Woodchucks, Ground Squirrels, Prairie Dogs, and Chipmunks

THE Order of Rodents, or *Rodentia,* is world-wide in distribution and includes more different species and a greater number of individuals than all the other orders of mammals combined. All the rodents, or gnawers, are characterized by having a single upper and an under pair of chisel-like front teeth, or incisors, specially adapted to cut vegetable fiber, whether it be the wood in the trunk of a tree, as in the case of the beaver, or the shelling of little seeds by the tiny, silky pocket mouse. They also completely lack the canine teeth which are so conspicuous in the carnivores.

Rodents have developed great variations in size, form, and habits to adapt themselves to special methods of life. Some are strictly diurnal; others are equally nocturnal, and still others are active both by day and night, as circumstances demand. In regions where severe winters prevail, some pass months in the deep sleep of hibernation.

The flying squirrels have developed a fold of the skin uniting the sides of the front and hind legs. When extended, it enables them to glide gracefully through the air from tree to tree. Although these are usually small animals such as we know in the United States, in parts of southern Asia some of them become giants of their kind, attaining a length of nearly four feet.

AQUATIC AND DESERT RODENTS

Some rodents, like the beaver, live in and about water, while others, like the kangaroo rats and mice, occupy waterless deserts. The variations in form among them well illustrate the manner in which the pressure of environment has brought about a multitude of special adaptations by which different mammals maintain "a place in the sun."

The well-known tree squirrels typify the Family *Sciuridæ* of rodents, but with them are also included the chipmunks, ground squirrels, prairie dogs, woodchucks, or marmots, and flying squirrels. Members of this family occur in most parts of the world except Australia. The marmots are the largest of the group. Among the tree squirrels the size varies from the pygmy species in Borneo, no larger than a house mouse, to giants in the Malayan region as heavy as a small house cat, but much longer.

WOODCHUCKS ARE "WHISTLERS"

Marmots, or woodchucks, of the Genus *Marmota,* live in most of Europe, in Asia down to the Himalayas, and in North America, from northern Canada and central Alaska to the mountains in the southern United States. In North America occur more than 25 species and geographic races. The gray forms of the Rocky Mountains are the largest of all and are known in much of their range as "whistlers." All have the habit of hibernation in winter.

Rock squirrels, Genus *Otospermophilus,* are close relatives of the small ground squirrels, but are larger and more heavily proportioned than any of that group, about equaling the large American tree squirrels in size. In both form and habits, they appear to be intermediate between the two groups named. They have well-developed ears and their tails are almost as long and bushy as those of the tree squirrels. At the same time, they are often semi-arboreal in habits and live in hollows near the bases of trees as well as in burrows they make under rocks or in open ground. Their cheek pouches and other characteristics tie them in with the ground squirrels.

They are a distinctively North American group, with about 15 species and subspecies. Their range extends from near the northern border of the United States, in Washington, to the southern end of the Mexican table-land.

MANTLED GROUND SQUIRRELS OF THE WEST

The beautiful members of the Genus *Callospermophilus,* the mantled ground squirrels, are a little heavier-bodied than the Eastern chipmunk, which they resemble in size and habits as well as in the stripes along the sides of the back. About a dozen species and subspecies are known, all living in the mountain ranges of western North America, from northeastern

British Columbia to southern Chihuahua, Mexico.

More than 50 species and subspecies of true ground squirrels belonging to the Genus *Citellus* occupy the western parts of North America, from the Mississippi Valley to the Pacific coast and from the Mexican table-land north to the Arctic coast of Alaska. Others occur in Asia and eastern Europe. Wherever these animals live in a severe climate, they hibernate during much of the winter. They are of small or medium size, with rather short-haired tails and small, rounded ears. Some are uniformly colored and others have lines of spots and stripes along their backs.

The little ground squirrels, known as "antelope chipmunks," Genus *Ammospermophilus,* are about the size of the Eastern chipmunk. Only two species with their numerous geographic races, are known. They live in parts of the arid plains of the southwestern United States, ranging down into similar parts of northern Mexico. The species described on page 120 carries its tail curled tightly over its back, so that its white undersurface shows conspicuously as it runs away. This, with the chipmunklike white stripe along the back, has given rise to the common name of this group. The other species, however, while having a close general resemblance to it, has a dark-colored tail which is also held in a recurved position, but is inconspicuous.

Prairie dogs, Genus *Cynomys,* are rodents closely related to the ground squirrels, from which they differ in their larger size, proportionately heavier bodies, and shorter tails. The genus contains two species and their geographic races, which are limited to treeless plains in the western United States and northern tablelands of Mexico. The species may be distinguished at a glance by the tips of their tails, black in one and white in the other.

More than 50 species and subspecies of chipmunks of the Genus *Eutamias* occupy western North America from northern Mexico to Yukon Territory, Canada, and eastward, overlapping the western and northern parts of the range of the Eastern chipmunk. They also occur through parts of northern Asia to eastern Europe. These Western animals are slenderer and have narrower stripes on the back than the Eastern chipmunk.

Eastern chipmunks belong to the Genus *Tamias,* which consists of a single species and its few geographic races, all confined to the eastern parts of Canada and the United States. They may be distinguished in life from their relatives of the Genus *Eutamias* by their more robust form and fewer and broader stripes along the back.

COMMON EASTERN WOODCHUCK, OR AMERICAN MARMOT: Marmota monax and its subspecies

(For illustration, see Color Plate, page 122)

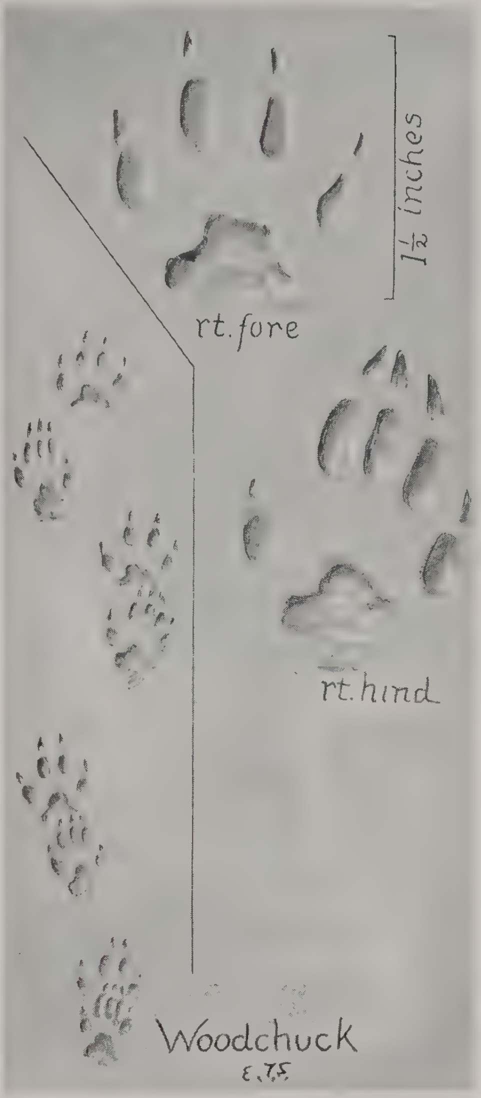
The woodchuck, or "ground hog" is a typical marmot, with coarse hair, heavy body, short neck, short, bushy tail, powerful legs, and feet armed with strong claws for digging. When fully grown it averages about ten pounds in weight. Its usual color is a grizzled brown, but in some districts black, or melanistic, individuals are not uncommon.

Marmots are common to Europe, Asia, and North America. The group contains many species and geographic races varying in size and color. The Alpine marmot of Europe is probably the most familiar of the Old World species, and the woodchuck the best known in America.

North America contains several species of marmots, their joint territory extending from coast to coast over the northern parts of the continent and from southern Labrador, the southern shores of Hudson Bay and Great Slave Lake, and central Alaska southward to northern Alabama, and along the high mountains to New Mexico and the southern Sierra Nevada of California. The common woodchuck is well known to every dweller in the countryside of the Eastern States and Canada, where it occurs from sea level to near the tops of the highest mountains, at altitudes of more than 4,000 feet.

It is a familiar inhabitant of fields and grassy hillsides, especially where bordering woodland offers safe retreat. In such places it digs burrows under stone walls, rocks, ledges, old stumps, or even out in the open grass-grown fields. It commonly lives in the midst of the forest, where its dens are located in a variety of situations. The burrows are marked by little mounds of earth at the entrances and ordinarily contain from 20 to 40 feet of branching galleries, one or more of which end in a rounded chamber about a foot in diameter, well lined with dry grass and leaves.

Within these warm nests the females bring forth from three to nine blind and helpless young about the last of April or early in May. A few



THE WOODCHUCK'S TRACK SHOWS KINSHIP WITH THE SQUIRRELS

The small series (left) shows the ordinary ambling pace of the common Eastern woodchuck, or American marmot. When speeding, it sets its feet much like the little, or Eastern, chipmunk (see page 131).

weeks later the young appear about the entrance of the burrows sunning themselves and playing with one another, but usually ready to disappear at the first alarm. At times, however, they are surprisingly stupid and may be captured with ease. The woodchuck has practically no economic value. Its flesh, while occasionally eaten, is little esteemed, and its coarsely haired pelts are worthless as fur.

It is a sluggish and stupid animal, which does not ordinarily go far from its burrow, but at certain seasons, especially in spring, it wanders widely, as though looking over its territory before locating for the summer. It has much curiosity and often sits upright on its hind feet to look about, remaining for a long time as motionless as a statue. When one is driven into its burrow, if a person approaches quietly and whistles, it will often raise its head in the entrance and look about to satisfy its curiosity.

Its only note is a short, shrill whistle, which it utters explosively at frequent intervals when much alarmed. At such times it also chatters its teeth with a rattling sound, as owls sometimes clatter their beaks.

Because of its habits, which are mainly diurnal, and its persistence in living in and about the borders of fields, the woodchuck is among the most widely known of our smaller mammals, and has long been the favorite game of the country boy and his dog. When cornered it will fight savagely and can inflict severe wounds with its strong incisors.

It feeds on grasses, clover, and other succulent plants, including various cultivated crops, especially vegetables in field and garden, where it sometimes does much damage. The holes and earth mounds it makes in fields, in addition to feeding on and trampling down grasses or grain, excite a strong feeling against it and farmers everywhere look upon the woodchuck as a nuisance. In New Hampshire, so great was the prejudice against these rodents that in 1883 a law was passed placing a bounty of ten cents each on them: "*Provided,* That no bounty shall be paid for any woodchuck killed on Sunday."

Unlike many rodents, the woodchuck does not lay up stores of food for winter. As summer draws to an end it feeds heavily and becomes excessively fat. On the approach of cold weather it becomes more and more sluggish, appearing above ground with decreasing frequency until from the end of September to the first of November, according to locality, it retires to its burrow and begins the long hibernating sleep which continues until the approach of spring.

Some time between February and April, according to latitude, it comes forth to resume its seasonal activities. In the northern parts of its range it usually comes out several weeks before the snow disappears and may be tracked in it while wandering about searching for food or a new location.

The prominence of the ground-hog as a popular figure in the country lore of the Eastern States is shown by his having been given a place with the Saints on the calendar, the second of February being widely known as "Ground Hog Day." It is claimed that on this date the ground hog wakes from his long winter sleep and appears at the mouth of his burrow to look about and survey the weather. If the sun shines so that he can see his shadow, bad weather is indicated and he retires to resume his sleep for another six weeks. Otherwise, the winter is broken and mild weather is predicted. Even on the outskirts of Washington some of the countrymen still appraise the character of the coming spring by the weather on Ground Hog Day.

Photograph by George Shiras, 3d

A GOLDEN-MANTLED MARMOT AT HOME IN A LOG PILE IN YELLOWSTONE NATIONAL PARK

These Western types of woodchucks are similar in general appearance and habits to the familiar animal of our Eastern States.

HOARY MARMOT, OR WHISTLER:

Marmota caligata and its subspecies

(*For illustration, see Color Plate, page* 121)

The whistler is the largest and handsomest of the American marmots. It is similar in proportions to the common woodchuck, but averages nearly twice its weight. Its fur, far thicker and of a better quality, might have a value in the fur trade if enough of the skins were available. As it is, the skins are used only for robes and sometimes for clothing by the Indians.

The distribution of this characteristic animal of the northern Rocky Mountains and outlying ranges extends from the Endicott Mountains, fronting the Arctic coast of Alaska, and the Alaska Peninsula, southeasterly to the Bitterroot Mountains of Idaho, Mount Rainier, the Olympics of Washington, and Vancouver Island. In the Far North its range extends from above timber-line down over bare slopes and through glacial valleys to the sea level along the southern coast of Alaska. To the southward it is limited wholly to the higher elevations, usually above timber-line.

Owing to variations in climatic conditions and to isolation in different parts of its range, several geographic races of the whistler have been developed. In the mountains to the southward of its range other marmots occur as far as New Mexico and California.

When the French-Canadian voyageurs on their fur-trading expeditions first visited the Rocky Mountains, they encountered the hoary marmots and applied to them the name *siffleur,* or whistler, which they had already given the common woodchuck of eastern Canada. The shrill note of the hoary marmot, under favorable circumstances, may be heard more than a mile and justifies the restriction of the name "whistler" to it.

The whistler lives in such remote and unfrequented districts that little is known of its life history. It is diurnal in habits and loves the free open spaces of the high mountain ridges. There its loud, oft-repeated call note, striking colors, together with its habit of running about on the snowbanks, render it unusually conspicuous.

High in the mountains it usually inhabits rock slides, the tumbled rock masses of glacial moraines, or rocky points, but sometimes takes up its abode on open earth slopes or in the bottoms of little glacial valleys. Ordinarily the dens are hidden in the rock slides and broken-down ledges, or burrows are dug under the shelter of large bowlders and even in open ground away from any rocky shelter.

During the sunny days of summer the whistler regularly frequents the top of some conspicuous bowlder or projecting rocky point, from which it commands a sweeping view of all its surroundings. Its sight and hearing are extraordinarily keen, and when perched on its lookout it is difficult to stalk. When one has its burrow located in an open place it often sits upright on its haunches to look watchfully about, and at the first alarm disappears into its den. This watchfulness is necessary, for even in the remote alpine highlands it occupies, the whistler is beset by enemies. The most formidable of these are the great brown and grizzly bears, which dig it from its burrow. In addition, prowling wolves or coyotes, Canada lynxes, wolverines, and eagles take occasional toll from its numbers.

Toward the end of summer, when the high alpine slopes are thickly grown with small flowering herbage, the whistler feeds heavily on many of the plants and, like the woodchuck at this season, becomes excessively fat. Before the arrival of winter it retires to the shelter of its den and begins the long hibernating sleep which may last six months or more. In spring, before the snowy mantle is gone from the mountains, it is out, ready to welcome the approaching summer. A few weeks later the three or four young are born. They remain with the mother throughout the season and during their first winter may hibernate in the home den.

The unspoiled wilderness of remote northern mountain slopes and ridges where the whistler lives is also the home of the mountain sheep, caribou, and huge northern bears. As the hardy sportsmen roam these inspiring heights in search of game, their attention is constantly attracted to the marmots, whose presence and shrill call notes lend a pleasing touch of life to many an otherwise harsh and forbidding scene.

CALIFORNIA ROCK, OR GROUND, SQUIRREL: **Otospermophilus grammurus beecheyi** and its relatives

(*For illustration, see Color Plate, page* 122)

Because of its habits, the California rock squirrel is known locally as the "digger," "rock," or "ground squirrel." Its prominent ears, bushy tail, color, and form give it the general appearance of a heavy-bodied gray tree squirrel, but in reality it is a true spermophile and close kin to the marmots.

Spermophiles are nearly circumpolar in distribution, ranging through northern lands from central Europe across Bering Strait to the Great Lakes in North America. Many species exist in North America, varying greatly in form, size, and color. They occur mainly in the western part of the continent from the Arctic coast of Alaska to the southern end of the Mexican table-land. Some species are represented by enormous numbers and do great injury to cultivated crops. Among the larger and best known of the injurious species, the California rock squirrel, with its several related geographic races, occupies most of the Pacific coast region from Oregon to Lower California and ranges eastward through the Great Basin and Rocky Mountain region to Colorado and Texas. It has a broad, vertical distribution, extending from the seashore to about 10,000 feet altitude on the western slope of the Sierra Nevada in California, and thrives under such contrasting climatic conditions as the humid northwest coast region and the most arid deserts of Lower California.

In California, where they are generally distributed and extremely numerous over great areas, these rock squirrels are most at home among the wild oats and scattered live oaks on the open slopes of the rocky foothills and thence up through the dense chaparral, scrub oaks, piñon pines, and junipers. Above this region they populate many beautiful little valleys in colonies, as well as parts of the splendid open forests of pine and fir. Below, they spread out from the foothills among the ranches in the great valleys. Wherever they occur, they take heavy toll from the native forage plants, and in cultivated areas their devastations of crops place them among the most serious of mammal pests.

They are omnivorous, eating insects and flesh on occasion, but feeding mainly on seeds, fruits, and many kinds of plants. The native vegetation in their haunts contains a wonderful variety of food plants, from humble weeds in the valleys to the lordly pines of the Sierra, but most attractive to these rodents are the rich food-bearers brought by the cultivators of the soil. The squirrels once gathered in great numbers about farms, and in feeding upon alfalfa, wheat, and other grains, grapes, peaches, apricots, almonds, prunes, pomegranates, and a variety of other crops, caused an annual loss to the farmers of California probably exceeding $20,000,000.

So serious were their depredations that great sums were spent in attempts to destroy them with poison. The Kern County Land Company, with vast holdings in the southern end of the San Joaquin Valley, in 1911 spent more than $40,000 for this purpose. This company estimated that the rock squirrels destroyed 20 per cent of the grain crop in great areas, and that twenty of them would destroy enough forage to support a cow through the year. The increase of losses from these pests, mounting with the growth of agriculture, impelled the Federal and State governments to organize poisoning campaigns. So successful has this method proved in reducing the squirrels' numbers that their depredations at present, although considerable, are small compared to their total some years ago.

Rock squirrels by choice locate their burrows among slide rock, in crevices among cliffs, under bowlders and roots of trees, in ditch or dry creek banks, or under stone walls, fences, or buildings. But in the parks of the high Sierra, as in the foothills and lowland valleys, they dig holes out in the open, with conspicuous mounds at the entrances much like those of the prairie dogs.

Well-worn trails lead from one of their burrows to another and away to a distance through the wild oats in the foothills, or in the grain and forage crops of the valleys, and along these the animals travel when foraging or paying social visits. Wherever a large rock, stump, or other prominent object is convenient, they spend hours on the top sunning themselves and keeping a sharp lookout over their surroundings. From

Photograph by George Shiras, 3d

A MINK TAKES ITS OWN PICTURE BY FLASHLIGHT

One of many remarkable Nature studies which have been made possible by George Shiras 3d's invention and development of animal flashlight photography, with the animals themselves as the photographers. The naturalist may have to spend hours, sometimes days, waiting in swamp or desert to study his quarry, but by means of flashlight photographs the inhabitants of the wild are revealed in their native haunts to all who read a story told in pictures.

these lookout points when they suspect danger they utter a short, shrill, whistling note which may be heard at a long distance and which sends all their neighbors scurrying for shelter. They also have a lower chattering note, uttered about the burrow when resenting an intrusion or when otherwise displeased.

Rock squirrels are agile climbers on cliffs and among rocks as well as in fruit trees, live oaks, and other low trees, but I have never seen them far from the ground in large trees. When on the ground they run in a series of bounds like tree squirrels. The long, bushy tail is carried almost straight out behind when they scamper off in alarm, but at other times it is curved and undulating, much as in the tree squirrels. They gather and manipulate food with their front paws, sitting upright on their haunches to eat or look about. On one occasion, when I came to a footbridge over a broad, irrigating ditch across which a number of rock squirrels were raiding an orchard, the culprits caught away from home did not hesitate to dash at full speed into the swiftly running water and swam quickly across to seek refuge in their holes on the far side.

Like other spermophiles, California rock squirrels hibernate for months in the cold, snow-covered parts of their winter range, but remain active throughout most of the year in the warmer areas, where no snow falls. Throughout their range they gather stores of seeds, grain, acorns and other nuts, carrying them in their cheek pouches to underground storerooms for use in bad weather. In the valleys of California they lie hidden in their burrows for days at a time during cold winter rains, but come out as soon as the sun reappears. One or more litters, each containing from six to twelve young, are born from March to late in summer, according to the locality. The young leave the nest and care for themselves when about half grown.

The former swarming abundance of the California rock squirrel on foothill slopes and in fertile valley bottoms equaled the congregations of prairie dogs in their most populous districts, and in some areas is still maintained, especially in the foothills. This abundance of small animal life supports a great variety of predatory species, as coyotes, foxes, bobcats, several kinds of hawks, and the golden eagle. This bird's predilection for rock squirrels has earned it protection by law in California, where many of them build their nests in low live oaks only a few yards from the ground.

When house rats brought the bubonic plague to San Francisco some years ago they carried it across the bay and passed it on to the rock squirrels living in the foothills back of Oakland.

Thence the disease spread among these animals through parts of several coastal counties. The United States Public Health Service and the local authorities in a vigorous campaign stopped the spread of this malady, but not until the potential ability of these rodents as plague carriers had been well established. This fact and the wide distribution of the California and other ground squirrels and spermophiles over a large part of the continent should not be overlooked in connection with possible future outbreaks of the plague. Fortunately, investigation and field experiments on a large scale have shown that these spermophiles may be destroyed by poison over great areas at a relatively small cost.

Photograph by George Shiras, 3d

A RED SQUIRREL RAIDS A CORNFIELD

As a rule, this animal keeps within the forests where it dwells, but it cannot resist the temptation of a neighboring patch when the kernels harden.

OREGON GOLDEN CHIPMUNK: **Callospermophilus lateralis chrysodeirus** and its relatives

(For illustration, see Color Plate, page 125*)*

The golden chipmunk, or calico squirrel, as it is named in Oregon, is the most richly colored of the several geographic races of a widely known species, *Callospermophilus lateralis,* abundant among the open forests of yellow pines and firs of the western ranges, including the Rocky Mountains, Cascades, and Sierra Nevada. Although commonly known as a chipmunk, this handsome animal is a ground squirrel, or spermophile, distinguished from all its kind by stripes, resembling those of a chipmunk, along the sides of its back. From the chipmunks it may be distinguished at a glance by its thickset and often almost obese proportions, which render its movements much slower and less graceful than they are with those nimble sprites. It occurs from northeastern British Columbia to New Mexico, southern California, and even in an area in the high Sierra Madre of southern Chihuahua, where an isolated representative occupies a limited range.

Their vertical distribution extends from a moderate elevation above the sea in Oregon to above 11,000 feet in southern California. They are common in the Yellowstone and other national parks, where their size, bright markings, and activities render them conspicuous.

Everywhere their habits resemble those of the various species of true chipmunks with which they associate. They live in burrows, which they dig under the shelter of logs, rocks, stumps, roots of trees, or even in open ground, as well as with conies in the ready-made shelter of rock slides, at timber-line. Their burrows at times have several entrances within a small area. Often they occupy the burrows of other animals, including pocket gophers. They excavate burrows under cabins or barns in clearings, and abandoned mining camps and old sawmill sites frequently abound with them. Nests and storage chambers are excavated off the passageways. The nests are usually made of leaves and other soft vegetable material, but

Photograph by George Shiras, 3d

A LAKE SUPERIOR CHIPMUNK FORAGING IN NORTHERN MICHIGAN

This slender little animal is the Eastern representative of a widely distributed species of the Rocky Mountain region. Like the Eastern chipmunk, it makes itself at home about camps in the woods.

in the sheep-grazing country wool, which they find in scattered tufts, is often used.

A camping party in their haunts is certain to attract them, and, as about barns, it is necessary to keep a watchful eye on them to prevent their robbing grain sacks or other supplies. When they once locate an accessible supply of grain their industry is remarkable. I have seen a dozen or more working throughout the day, making continuous hurried trips, with loaded cheek pouches, to their dens, sometimes 200 yards away. On approach of autumn they become continually active, gathering their winter supplies.

The length of their hibernation varies with the severity of the climate, but is rarely under five months. It is said to run through seven months on the higher mountains of southern California. They usually go into winter quarters in September or early in October, but occasionally one may be seen out as late as December. At this time they have become so fat that their movements are very sluggish. One kept as a pet for eleven years at Klamath Falls, Oregon, is reported to have hibernated regularly each winter. In Montana they retire to their dens in September and come out in March. They mate soon after they appear in spring and the young, four to seven in number, are half grown the last of May.

Like true chipmunks, these spermophiles are fond of weedy clearings or other openings in the forest, where stumps, logs, rocks, and old fences offer plentiful shelter and many elevated vantage points where they may sit by the hour watching the doings of their small world. They have a sharp whistling or chirping call note, usually uttered as a warning cry, but sometimes as a social call. They do not like gloomy or stormy weather and generally lie hidden at such times, but on sunny days are so actively engaged in foraging, running along the tops of logs, or perching on the tops of stumps and large rocks, that they add greatly to the pleasant animation of the forests where they live. When running they usually carry the tail elevated like a chipmunk.

They sun themselves for hours on elevated points, sometimes lying quiescent and again sitting bolt upright, but always watchful and ready to disappear at the slightest alarm. This watchfulness is necessary, for their enemies are abroad at all hours. They are the prey of bobcats, foxes, coyotes, weasels, snakes, and hawks.

The golden chipmunk and its related subspecies are omnivorous feeders. They show a strong predilection for bacon when looting camp stores and eat any kind of meat with avidity. Young birds and birds' eggs are devoured whenever found, as are also grasshoppers, beetles, flies, larvæ, and many other insects. The number of kinds of seeds eaten is almost endless and includes chinquapin and pine nuts, rhus, alfilaria, violet, lupine, ceanothus, and others.

They also eat roses and other flowers, green leaves, wild currants, gooseberries and other fruit, and small tuberous roots. They often climb bushes and low trees, at least 30 feet from the ground, after nuts and berries. The capacity of their cheek pouches is shown by an instance when one animal was loaded with 750 service-berry seeds. The pouches of another contained 360 grains of barley, and of still another 357 grains of oats. Bold and persistent camp robbers, their depredations cover all articles of food, including bread and cake, and they sometimes do considerable injury to small mountain grainfields.

I had the pleasure of living in the mountains of New Mexico and Arizona for several years, where these attractive ground squirrels were numerous, and vividly remember them as among the most interesting of the woodland folk. Their friendliness about forest cabins is notable and with a little encouragement they become extremely confiding and amusing visitors.

The young are playful, pursuing one another in apparent games of "tag" over rocks, stumps, and logs. When partly grown, they have all the heedlessness of youth. On one occasion an observer saw the mother repeatedly push the young back into crevices in a rock slide with her front feet, as they persisted in trying to come out to look at the strange intruder in their haunts.

STRIPED GROUND SQUIRREL: **Citellus tridecemlineatus** and its subspecies

(For illustration, see Color Plate, page 125)

Small size and a series of thirteen narrow, well-defined stripes, or lines, marking the upperparts of the striped ground squirrel serve to distinguish it from all its relatives. Its total length is about eleven inches and its form is nearly as slender as that of the weasel. Its brightly colored markings blend so well with the brown earth and plant stems in its haunts that when quiet it is difficult to distinguish. This protective coloration is of vital service to a small animal sought by all the diurnal birds of prey, as well as by coyotes, foxes, bobcats, badgers, skunks, weasels, and snakes.

The striped ground squirrel, also known as the "gopher" or "striped gopher," is restricted to middle North America, where it is distributed from southern Michigan and northern Indiana west to Utah, and from about latitude 55 degrees in northern Alberta south nearly to the Gulf coast of Texas. It ranges from near sea level in Texas to about 10,000 feet in Colorado. Within these limits the varying climatic conditions have modified it into several geographic races, all having a close general resemblance.

Like most members of the squirrel family, the striped ground squirrels are diurnal in habits and well known wherever they occur. I first learned the ways of these odd little mammals as a boy on the prairies outside the city of Chicago, and later observed them in a high mountain valley in Arizona. In both regions they had the same habits. By preference they occupy grassy prairies, old fields, and similar situations. In many areas their large numbers and destructiveness to grain crops make them serious pests, but where the land is generally cultivated, the sheltering vegetation and their shallow burrows are destroyed by the plow.

The lives of the striped ground squirrels are so beset with peril that they always move abroad with watchful hesitation, pausing to listen, retreating toward their burrows at the slightest suspicious sound or movement, or rising bolt upright on their hind feet and remaining motionless as a small statue until satisfied that there is nothing to fear. They call to one another with a chirping note as well as with a shrill trilling whistle. When alarmed by the presence of some enemy their warning call notes are heard on all sides as the alarm is passed, and all are on the alert to disappear down their burrows at the slightest suspicious movement.

When they have vanished, their trilling notes are often heard from the depths of their burrows; but curiosity is one of their strongest traits, and if no disturbance follows one will almost immediately pop up its head to see the cause of the alarm. Boys, taking advantage of this habit, place an open slipping noose at the end of a long string around the entrance of the burrow, and, waiting developments, lie quietly a few yards to one side. The ensuing silence is too much for the ground squirrel to endure, and soon its head appears above ground. The boy pulls the string and drags the victim forth with the noose about its neck.

The entrance to the burrow of these ground squirrels is about two inches in diameter. It is usually located in the midst of grass or weedy growths, and has little or no fresh earth about it. The burrow descends nearly vertically for several inches and then turns almost horizontally in a sinuous and erratic course, with numerous branches and side passages leading up to the surface. Most of these side entrances are kept plugged with soft earth. Opening off the main tunnel is a large nest chamber filled with fine dry grasses and other soft vegetable matter, and also one or more large storage chambers in which the owner lays up his garnered supplies of grain or other seeds for use during inclement weather.

These squirrels hibernate throughout their range, entering their long sleep in an excessively fat condition the last of September or in October. In the North they remain in a torpid state for six months or more.

Soon after they appear in spring they mate and the single litter of the year, containing from five to thirteen young, is born the last of May or early in June. The young are in an extremely undeveloped state at birth, being blind, hairless, and with the ears scarcely showing. They develop slowly and remain with the mother until toward fall, when, nearly grown, they scatter to care for themselves.

The striped ground squirrels are among the most carnivorous of rodents. Although they devote much time to gathering grain, seeds of various kinds, and even acorns and other nuts, which may be eaten on the spot or carried in their cheek pouches to their underground storage rooms, they are also known to eat insects and flesh whenever occasion offers. In fact, during seasons when such insect food as grasshoppers, caterpillars, and grubs is plentiful, these ground squirrels frequently feed mainly upon it. They are known to kill and devour mice and young birds, and when confined in a cage will sometimes kill and partly devour their own kind. When caught they fight fiercely, biting and struggling to escape. In captivity they show little of the gentleness and intelligence which are such pleasing characteristics of chipmunks and true squirrels.

ANTELOPE CHIPMUNK: **Ammospermophilus leucurus** and its relatives

(*For illustration, see Color Plate, page* 126)

This handsome little mammal, also known as "white-tailed chipmunk," is in reality a species of spermophile, or ground squirrel. The misnomer is due, no doubt, to its small size, striped back, and sprightly ways. From the true chipmunks it may be distinguished by its heavier proportions, and from both chipmunks and all other spermophiles by its odd, upturned tail, carried closely recurved along the top of the rump. This character renders the species unmistakable at a glance and gives it an amusing air of jaunty self-confidence.

The antelope chipmunk is characteristic of the arid plains and lower mountain slopes of the Southwest from western Colorado through Utah, northern Arizona, Nevada, the southern half of California, and all of Lower California, and down the Rio Grande Valley through New Mexico to western Texas.

Within this area it occupies a wide variety of situations. It inhabits the intensely hot desert plains near sea level in Lower California, where the temperature rises to more than 125 degrees Fahrenheit in the shade and the vegetation is characterized by such picturesque forms of plant life as cacti of many species, yuccas, fouquierias, paloverdes, ironwood, and creosote bushes; it is found also above 7,000 feet altitude on the cool plateaus and mountain slopes of Arizona and Colorado, among sagebrush, greasewood, junipers, and piñon pines. It appears equally at home skipping nimbly over rocky slopes or among slide rock in arid canyons and scurrying through the brushy growth on broad, sandy plains devoid of rocks.

The antelope chipmunk has the most vivacious and pleasing personality of all the numerous ground squirrels within our borders. During the many months I have camped and traveled on horseback in their haunts I have never lost interest in them. They are forever skirmishing among the bushes or dashing away down trails or over the rocks of canyon slopes, their white tails curled impudently over their backs like flags of derision at my cumbersome advance.

Their burrows are dug in a variety of places. In the open flats they enter the ground almost vertically, and often several entrances are grouped within a few yards. In some places a little mound of loose dirt is heaped up at one side of the entrance and at others there is no trace of it. Frequently, when the ground is soft, little trails lead in different directions from the entrances, and often between holes 100 yards or more apart, as though they made many social visits. The deserted burrows of other mammals are sometimes utilized to save the trouble of digging. The burrows are often under the shelter of cacti, bushes, and great bowlders, or may be among crevices in the rocks.

Antelope chipmunks are extraordinarily active and continually wander far from home in search of food or in a spirit of restless inquiry. As the traveler on horseback rides slowly along, he will see them racing away in front of him, sometimes climbing to the top of a bush 100 or 200 yards in advance for a better look at the wayfarer, and then scuttling down and racing on again. In this way I have seen them keep ahead of me sometimes for several hundred yards instead of hiding in some hole or shelter, as they might easily do. At other times they were so unsuspicious that they would permit me to pass within a few yards with slight signs of alarm. They have a chirping call, often uttered when watching from the top of a bush, and also a prolonged twittering or trilling note, diminishing toward the end.

In the higher and colder parts of their range, where snow lies long on the ground, these spermophiles hibernate for several months, but in the warmer areas they are active throughout the year. Wherever they occur they gather food and carry it to their underground storerooms in their cheek pouches. Like most ground squirrels, they eat many kinds of seeds and fruits as well as flesh and insects when occasion offers. About cultivated land they are sometimes abundant and destructive, digging up corn or other grain as soon as it is planted and also taking toll of the ripening grain until they become a pest. In the desert they often gather about camps to pick up the grain scattered when the horses are fed.

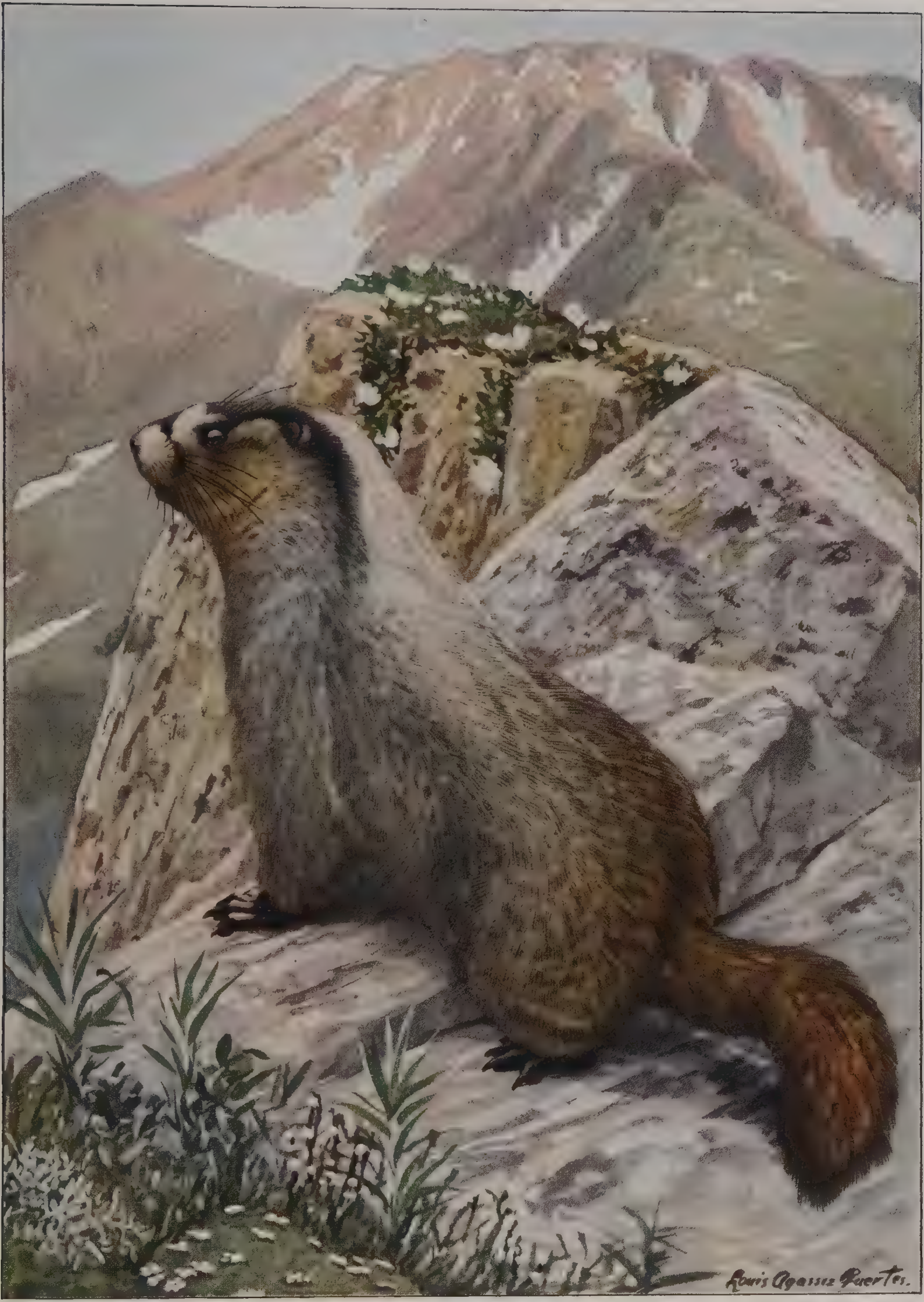
It is well for them that they are prolific, having one or more litters during spring and summer, with from four to twelve in each, as they have many enemies. Snakes and weasels pursue them into their burrows, while foxes, coyotes, badgers, bobcats, and many kinds of hawks constantly reduce their numbers.

BLACK-TAILED PRAIRIE DOG: **Cynomys ludovicianus** and its relatives

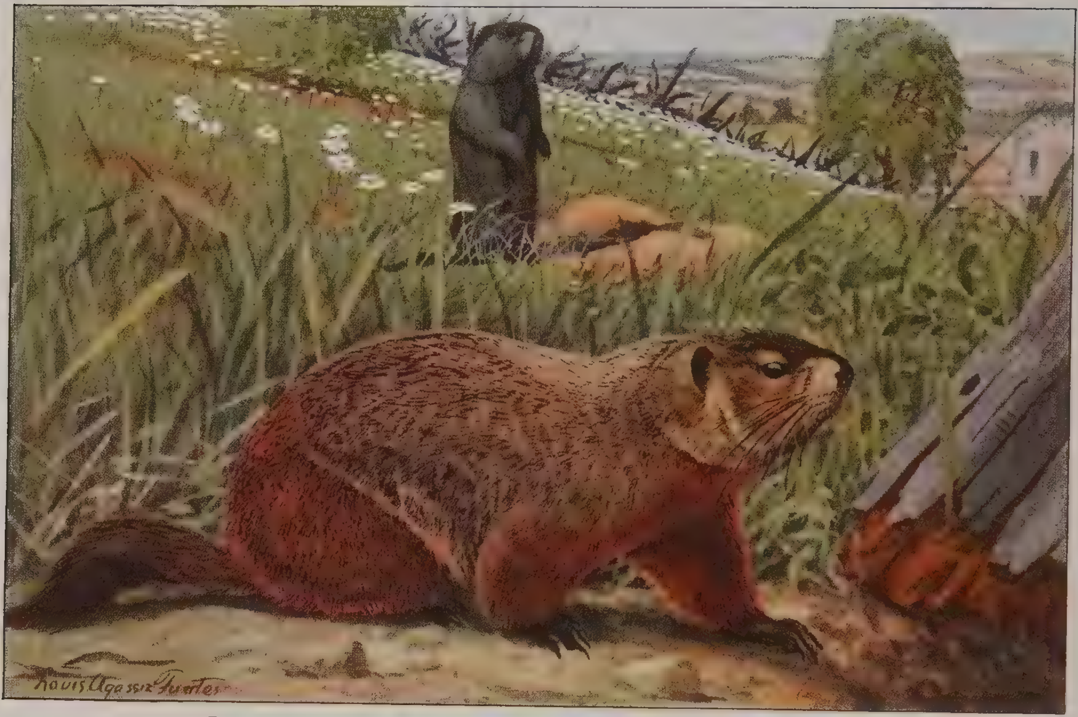
(*For illustration, see Color Plate, page* 126)

Prairie dogs are not "dogs," but typical rodents, first cousins to the ground squirrels, or spermophiles. As a rule, they may be distinguished from the ground squirrels by their larger size, proportionately shorter and heavier bodies and shorter tails. In length they vary from 14 to more than 17 inches, and in weight from one and one-half to more than three pounds.

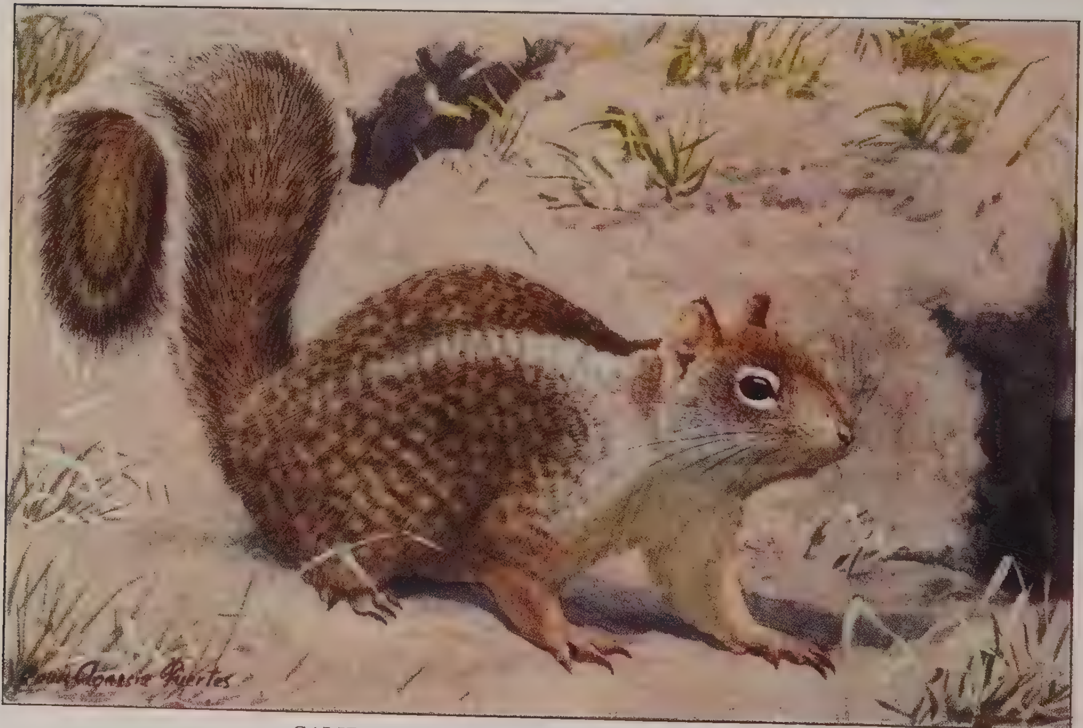
These rodents are limited to the interior of North America and form a small group of six species and geographic races. Although closely alike in general form and habits, the species are


Louis Agassiz Fuertes.

HOARY MARMOT, or WHISTLER
Marmota caligata



COMMON EASTERN WOODCHUCK, or AMERICAN MARMOT
Marmota monax



CALIFORNIA ROCK, or GROUND, SQUIRREL
Otospermophilus grammurus beecheyi

divided into two sets: one, the most widely distributed and best known, having the tails tipped with black, and the other having the tails tipped with white.

On the treeless Western Plains and valleys from North Dakota and Montana to Texas and thence west across the Rocky Mountains to Utah and Arizona, they are one of the most numerous and characteristic animals. Southward they range into northwestern Chihuahua and one species occupies an isolated area on the Mexican table-land in southern Coahuila and northern San Luis Potosí, Mexico. Their vertical range varies from about 2,000 feet on the Plains to about 10,000 feet in the mountainous parts of Colorado and Arizona.

Owing to their diurnal habits, their exceeding abundance over vast areas, and their interesting mode of living in colonies, prairie dogs have always attracted the attention of travelers and have become one of the most widely known of our smaller mammals. All who have lived in the West, or who have merely traversed the Great Plains on the transcontinental railroads formerly had their interest excited by these plump little animals sitting bolt upright by the mounds which mark the entrances to their burrows, or scampering panic-stricken for shelter as the train roars through their "towns." Their destructiveness to crops and forage has caused them to be destroyed over much of their former range, so they are no longer a common sight from passing car windows.

So strong is the gregarious instinct in prairie dogs that they customarily make their burrows within short distances of each other, varying from a few yards to a few rods apart. The inhabitants of these communities, or "towns," as they have often been termed, vary in number from a few individuals to millions. In western Texas one continuous colony was about 250 miles long and 100 miles wide. In the entire State of Texas 90,000 square miles were occupied by prairie dogs, and the number of these animals within this area ran into the hundreds of millions. The extent to which they occupy parts of their territory is well illustrated by one situation containing about a square mile in a mountain valley of eastern Arizona, which by actual count contained 7,200 of their burrows.

The burrows, from four to five inches in diameter, are usually located on flat or gently sloping ground. They descend abruptly from 8 to 16 feet, then turn at a sharp angle, and extend 10 to 25 feet in a horizontal or slightly upward course. The tunnel at the end of the steep descending shaft is always more or less irregular in course, and branches in various directions, the branches often ending in a rounded nest or storage chamber, but sometimes forming a loop back to the main passageway. Not infrequently two entrances some distance apart lead to these deep workings. A little niche is ingeniously dug on one side of the steep entrance shaft, four to six feet below the surface, to which, on the approach of danger, the owner retires to listen and determine whether it may or may not be necessary to seek safety in the depth of the den. It is from these vantage points that the resentful voices of the inhabitants come to a passing intruder in a prairie-dog "town."

The black-tailed prairie dog, which is so numerous on the Great Plains, surrounds the entrance to its burrow with a crater-shaped pyramid of soil varying from a few inches to nearly two feet in height and serving perfectly as a dike to keep out the water. The owners keep the funnel-shaped inner slopes of the rims about the entrances in good condition by setting briskly to work to reshape them at the end of a rain-storm, digging and pushing the earth in place with their feet and molding it into a more compact mass by pressing it in with their blunt noses.

The white-tailed prairie dogs usually pile the dirt from their excavations out on one side of the entrance, as in the case of most other burrowing animals. Sometimes the dirt in these piles amounts to from ten to twenty bushels, thus indicating extended underground workings.

The vivacity and hearty enjoyment of life by the occupants of a prairie-dog town is most entertaining to an observer. With the first peep of the sun above the horizon they are out on the mounds at the entrances of their burrows, first sitting erect on their hind feet and looking sharply about for any prowling enemy. If all is well, they begin to run about from one hole to another, as though to pass the compliments of the day, and scatter through the adjacent grassy feeding ground.

The favorite food of prairie dogs consists of the stems and roots of grama grass and other richly nutritious forage plants. In addition, they eat any native fruits, such as that of the pear-leaved cactus (*Opuntia*), and are extremely destructive to grain, alfalfa, and other cultivated crops. They also eat grasshoppers and are fond of flesh, sometimes being caught far from their homes in traps set for carnivores. They keep the grass and other vegetation cut down or entirely dug out over much of the town and especially in a circle about each entrance mound, apparently for the purpose of obtaining a clear view as a safeguard against the approach of any of their many four-footed enemies. This habit is exceedingly injurious to the cattle ranges and often results in much erosion of the fertile surface soil.

The vast numbers of prairie dogs over so large a part of the grazing areas of the West took a heavy toll from the forage and other crops. As a consequence for years a campaign of destruction has been waged against them as the country has become more and more settled, and they will eventually disappear from most of their range.

However detrimental they may be from an economic point of view, they are among our most interesting species, and when taken young their playful disposition and intelligence render them most entertaining captives.

Owing to the constant danger to which they are subject from coyotes, foxes, bobcats, badgers, and black-footed ferrets, in addition to eagles and other birds of prey, prairie dogs are constantly on the alert. At any suspicious occurrence the first to observe it runs to his entrance mound, if the danger is not pressing, but otherwise to the nearest mound, where he sits up at his full height, "barking" and vibrating his tail, ready, if necessary, to disappear instantly. At the same time the town is alive with scurrying figures of the inhabitants rushing panic-stricken for their homes, and the air is filled with a chorus of their little barking cries. When all have been frightened to cover, barking continues in the burrows, but an hour or more may pass before a dog will reappear.

I once stalked a solitary antelope by creeping flat on the ground through a prairie-dog town. As I drew near the first burrows, the dogs all rushed to their mounds, sitting there and barking at the queer and unknown animal thus invading their precincts. The strange sight excited as much curiosity among them as alarm. As I approached one mound after another the owners would become almost hysterical in their excitement and would sit first on all fours and then stand up at full height on their hind feet, the tail all the time vibrating as though worked by some mechanism, while the barking continued at the intruder as rapidly and explosively as possible. When I came within six or eight feet the dog would dive down his hole, sputtering barks from the depths as he went, but often would pop up again to take another look before finally disappearing. In this way I passed ten or a dozen mounds, while the dozens of dogs off my line of progress worked themselves into a frenzy of curiosity and protest. When the stalk was finished, I passed back through the town and my upright figure was promptly recognized by the inhabitants as that of an enemy. Everyone disappeared before I was within 50 yards of the first mound.

The common note of the black-tailed prairie dogs is a squeaking "bark," much like that produced by squeezing a toy dog; in addition, there is a rapid chattering note, often given as the dogs vanish down the hole. The white-tailed species has a shriller, more chirping note. In both species the odd, vibrating motion of the tail, held stiffly close to the back, is characteristic.

Prairie dogs hibernate in severe weather, those living in high, snow-covered mountains or in the extreme north sometimes sleeping through five or six months. In many places their hibernation is irregular, and near the southern border of their range is limited to a few inclement days now and then. In Wyoming they come out the last of March or early in April, sometimes when there is a foot or two of snow on the ground and the temperature ranges far below zero. Under such conditions they run about over the snow during the middle of the day, feeding on projecting tips of vegetation or digging to the ground.

Beginning near the southern border of their range and proceeding north, the single litter of the season, containing from four to six young, is born in March, April, or May. A month later, when scarcely larger than chipmunks, they may be seen playing about the entrance mound. When danger appears, the mother sends the young helter-skelter for the refuge of the burrow, and should any be slow about going in, she rushes at them, driving them to cover with shrill barks of alarm. When about half-grown the young scatter and prepare burrows of their own. Sometimes as many as six to nine of these animals may be found in a single burrow, in which, no doubt, they have taken refuge, or it may be a reunion of the season's family.

On warm sunny days, especially at a time when nights are frosty, these fat little animals will often lie flat on the bare ground about their mounds, with legs outstretched, basking in the grateful rays. As their colonies expand by the rapid increase of their numbers, many individuals wander far in search of new locations. On the mountain plateaus of northern Arizona, I know of instances where they traversed several miles of pine and fir forest to locate in an isolated mountain park, and new colonies were established as far as six miles from their nearest neighbors.

The flesh of prairie dogs is not unpalatable, and Navajo and Pueblo Indians are extremely fond of it. The Indians take advantage of heavy rains and turn the temporary rush of water down the holes to drown out the dogs, and thus capture many of them.

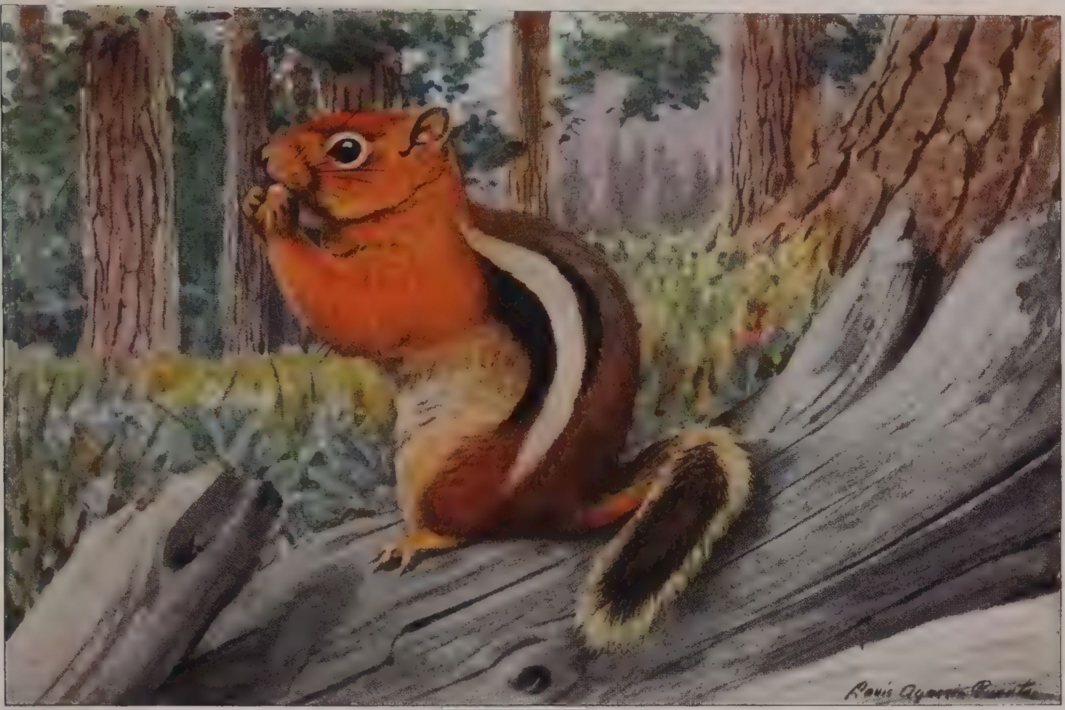
It is inevitable that many popular misconceptions should grow up about such numerous and interesting animals as the prairie dogs. In the West many people believe that the burrows go down to water. In reality, like many other rodents, these animals have acquired the ability by chemical action in the stomach to transform the starchy food into water. I have seen dog towns located on a few feet of soil resting on a waterless lava bed miles in extent and more than 100 feet thick, as shown by canyons cut through it, thus proving the impossibility of the prairie-dog-well legend.

Another popular belief is that the rattlesnakes and burrowing owls living in prairie-dog towns unite as a kind of happy family in the burrows of the dogs. The truth is, the owls live and breed in deserted dog holes, while the rattlesnakes visit the occupied holes to feed on the unfortunate occupants and may use deserted burrows as a convenient domicile while subsisting on their neighbors.

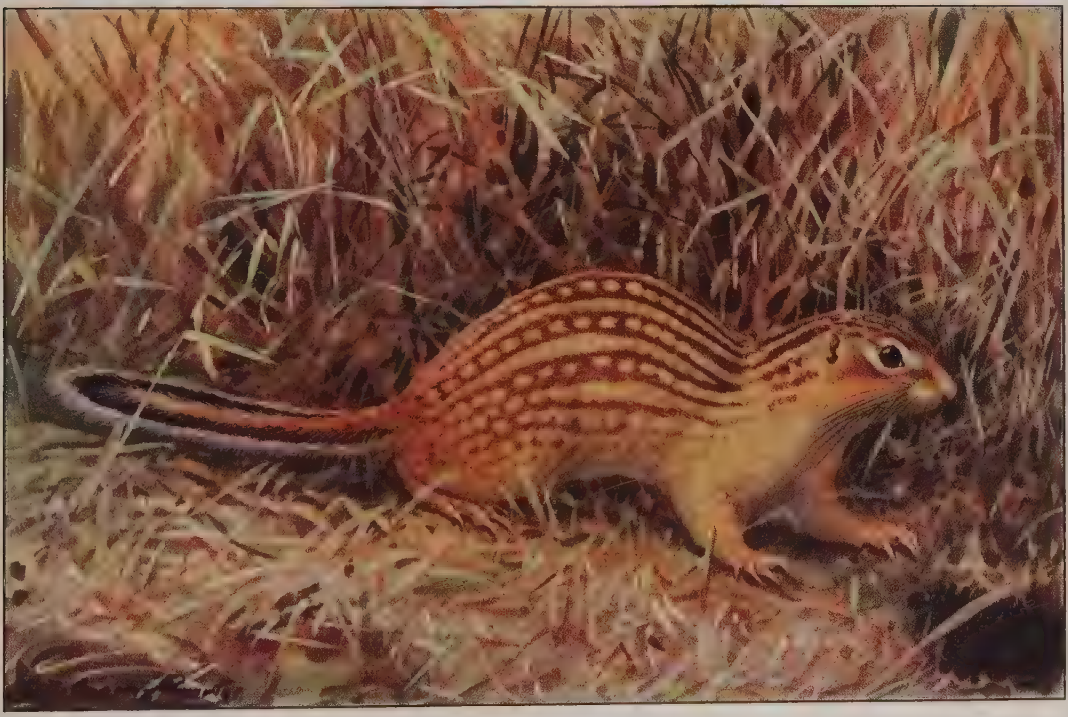
UTAH PAINTED CHIPMUNK: Eutamias minimus pictus and its relatives

(*For illustration, see Color Plate, page* 128)

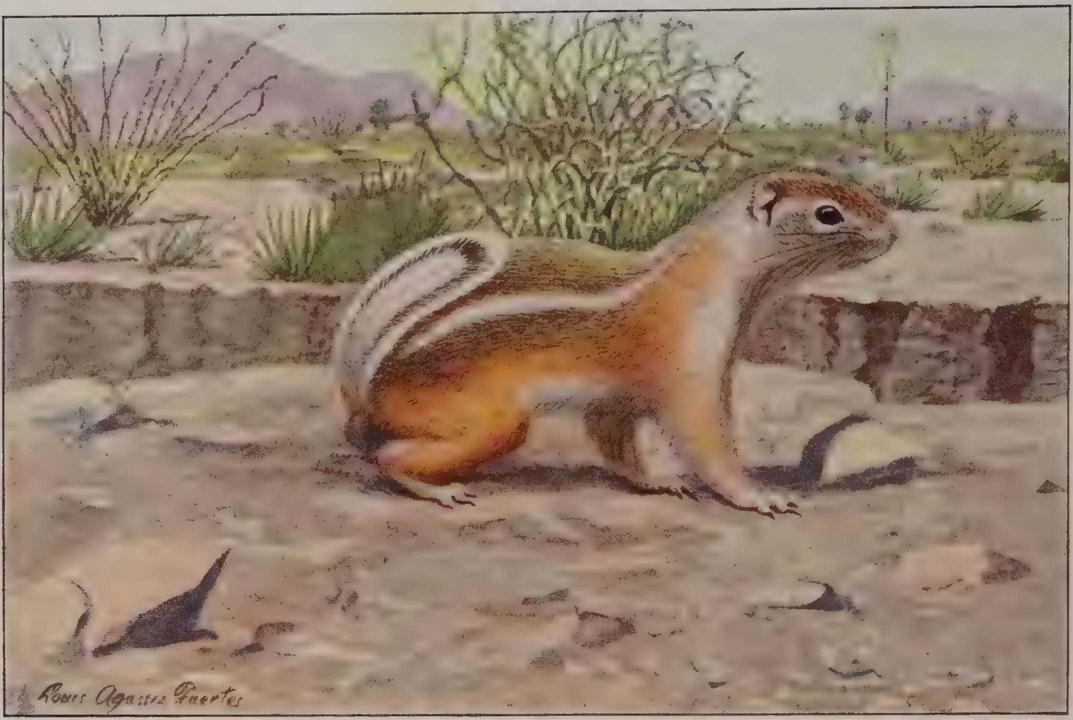
The following sketch tells how the Oregon chipmunk, living under a cool, humid climate, in a region of great forests, has responded to its environment by developing dark colors and a robust physique. The painted chipmunk of the Great Basin has given an equally perfect response to entirely different conditions. It is one of the geographic races of a species peculiar to the sagebrush-covered plains and hills from the Dakotas across the Rocky Mountains and the Great Basin region to the east slope of the Cascades and the Sierra Nevada. Its home is on treeless plains, in a climate characterized by brilliant sunshine and clear, dry air. In this environment the painted chipmunk has developed a smaller and slenderer body than the Oregon species, and strikingly paler colors.


Louis Agassiz Fuertes

OREGON GOLDEN CHIPMUNK
Callospermophilus lateralis chrysodeirus



STRIPED GROUND SQUIRREL
Citellus tridecemlineatus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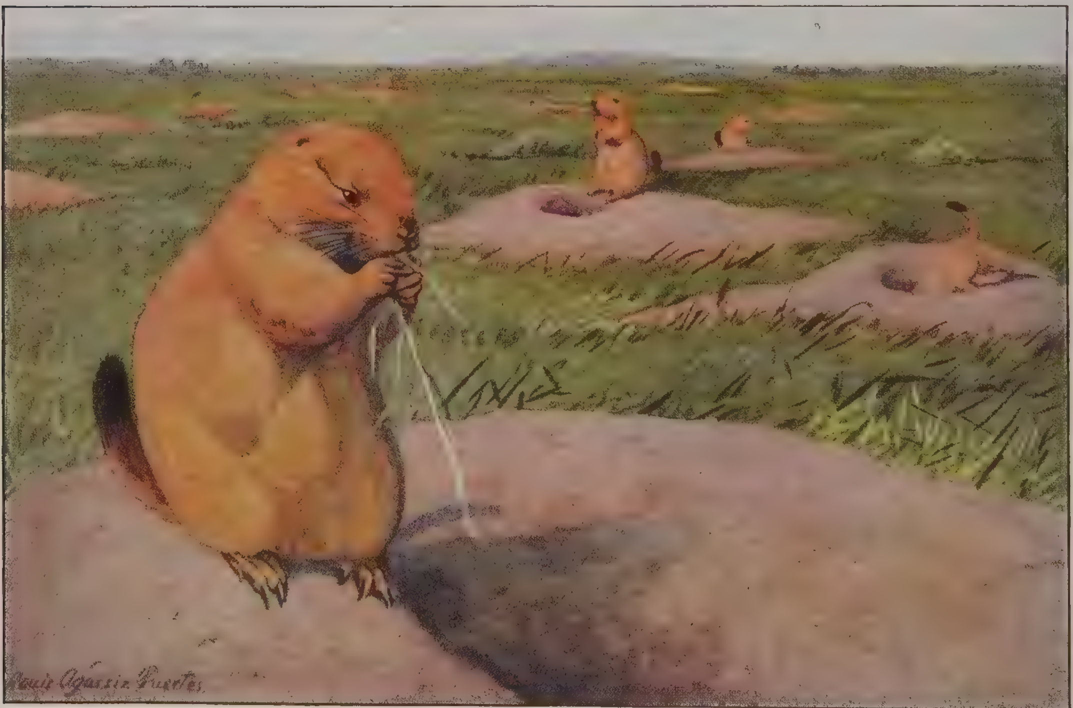
ANTELOPE CHIPMUNK
Ammospermophilus leucurus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BLACK-TAILED PRAIRIE-DOG
Cynomys ludovicianus

These differences in physique are accompanied by equal differences in mental and physical expression. These little animals are exceedingly alert and agile, darting through dense growths of bushes with all the easy grace of weasels. When running they hold the tail stiffly erect. When alarmed they utter a shrill chippering cry, especially when darting into shelter. They also have a chucking call, uttered at intervals, which may be used merely as a note of sociability or to put their neighbors on the alert.

Although one of the most distinctive animals of the sagebrush plains, this chipmunk also ranges into the borders of open forests on the mountain sides. It is most numerous on flats and foothill slopes among heavy growths of sage and rabbit brush. When its territory is invaded by settlers, it does not hesitate to gather about the borders of fields and even to raid barns in search of grain and other food. Its burrows are dug under large sagebrush and other bushes and under rocks and similar shelter.

As with others of their kind, painted chipmunks habitually gather seeds of many plants and carry them in their cheek pouches to their underground dens. In addition to seeds and green vegetation, they eat any fruits growing in their haunts, and also many insects, especially grasshoppers and larvæ. In one locality in Nevada during June and July, more than half their food consisted of a webworm and its chrysalids with which the sage bushes swarmed. The chipmunks climbed into the bushes and pulled the larvæ from the webs. As half the bushes were infested, the work of the many chipmunks had a material effect in reducing the numbers of this pest. The vegetable food eaten includes the seeds of *Ribes, Kunzia, Sarcobatus,* pigweed, and many other weeds, service-berry, various grasses, oats, wheat, and the seeds of small cacti. They regularly climb into the tops of large sage and other bushes for their seeds and the ground beneath is often covered with the small sections of twigs cut by them. They climb readily and often travel from bush to bush through tall thickets like squirrels in tree-tops. On warm mornings after frosty nights they may be seen in the tops of the bushes basking in the sun.

Throughout most of their range they begin hibernation in September or October, and reappear early in spring. The young appear a month or more later, and litters containing from two to six may be born throughout the summer, indicating the possibility that several litters may be born to the same pair in a season.

So alert and shy are they that even a person in their haunts day after day will see but few of them. Their hearing is extremely acute, and even at a great distance the footsteps of an intruder set them all on the alert. On every side they run swiftly to cover before the observer has opportunity to see them. In such places a large setting of baited traps will reveal their presence in surprising numbers. In one locality, during a brief visit, traps set among the brush for other small mammals yielded more than 40 chipmunks.

On stormy and cloudy days, especially if the weather is cool, painted chipmunks remain in their dens, but on mild, sunny days they frisk about with amazing quick darting movements. A horseman riding along a road leading through a sagebrush flat will frequently see them racing across the road often several hundred yards away, the sound of the horse's footfalls having alarmed the chipmunks over a wide area. Here and there one may be seen climbing hastily to the top of a tall bush to take a look at the cause of alarm before finally seeking concealment. When pursued among the bushes, they often run considerable distances before taking refuge in a burrow. When hard pressed they will enter the first opening encountered, but if it is not its own home the fugitive soon comes out and scampers away, evidently fearful of the return of the owner or perhaps owing to his presence.

Apparently, as in the case of many other desert mammals, the painted chipmunk, with its related races, is able to subsist without drinking, since it is often seen far out on arid plains many miles from the nearest water.

As with all its kind, the world of the painted chipmunk is filled with imminent peril of sudden death. Overhead, gliding on silent pinions, are hawks of several species, while on the ground snakes, weasels, badgers, bobcats, foxes, and coyotes are ever searching for them as prey.

OREGON CHIPMUNK: Eutamias townsendii and its relatives

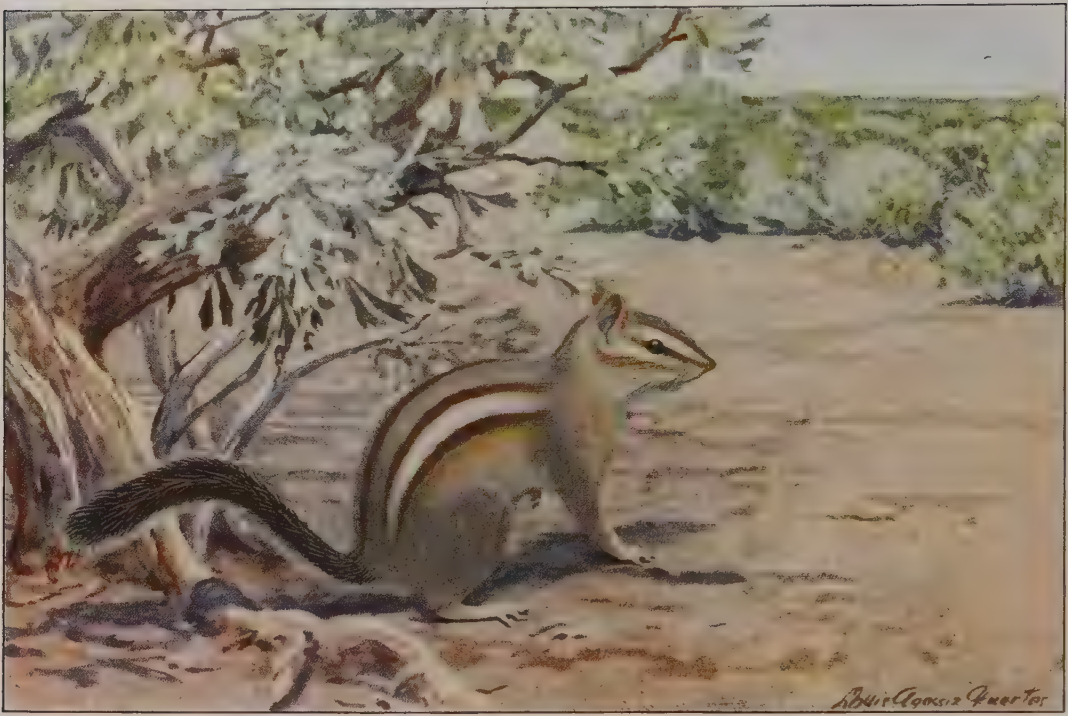
(*For illustration, see Color Plate, page* 128)

The resident species of birds and mammals in the humid coastal region of Oregon, Washington, and southern British Columbia are strikingly characterized by their darker and browner colors in comparison with closely related species in more arid districts.

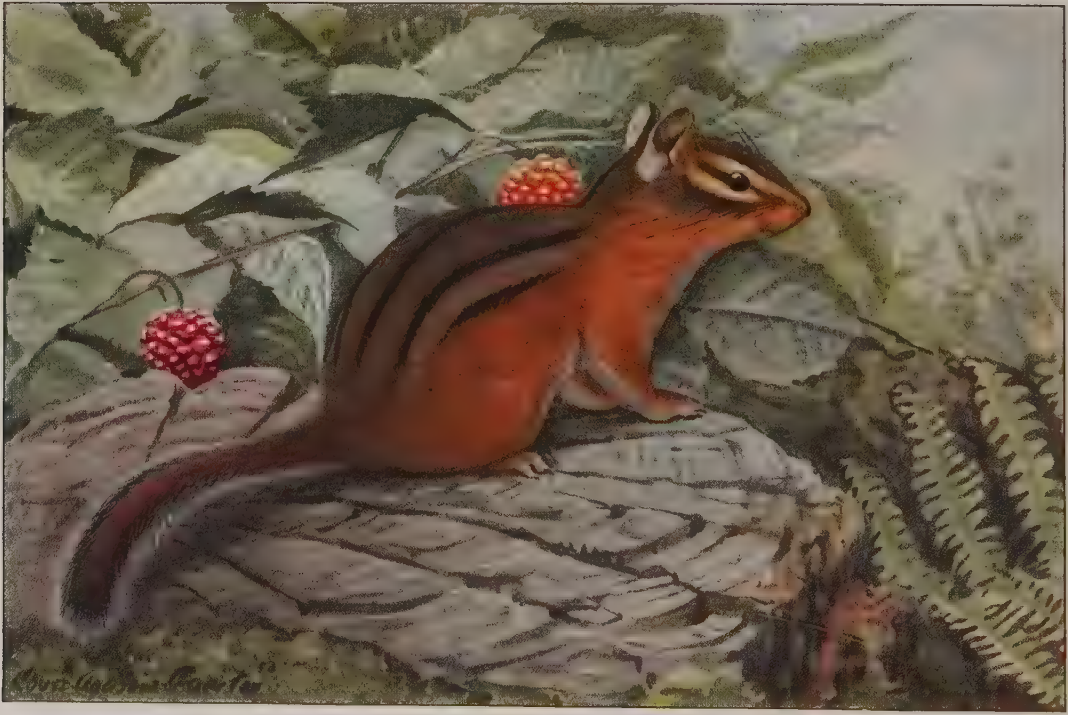
The Oregon chipmunk is one of the common species showing marked response to these local climatic conditions and is the darkest of all the many species of chipmunks in the Western States. It is one of several geographic races into which the species is divided by changing environment. As a whole, they range along the west coast from British Columbia to Lower California, and the races at the extremes of the line differ much in color.

As befits an inhabitant of the humid forested region, the Oregon chipmunk is robustly built and distinctly larger than the other chipmunks of the Western States. It is common and generally distributed throughout this region, occurring from among the drift logs along the ocean beach to above timber-line on the Cascade Range. Within these limits it frequents almost every variety of situation. It occurs in the midst of gloomy forests of giant spruces, cedars, and firs, but is particularly fond of old fences and brush patches on the borders of farm clearings in the valleys as well as the vicinity of rocky ledges, brush piles, and fallen timber, where the low thickets offer a variety of food-bearing plants and ready shelter.

On the mountains it is most numerous about rock slides and "burns" or other openings in the forest. Several pairs usually haunt the vicinity


Louis Agassiz Fuertes

UTAH PAINTED CHIPMUNK
Eutamias minimus pictus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OREGON CHIPMUNK
Eutamias townsendii

of old sawmills and of mountain cabins. Like others of their kind, they are alert and vivacious, varying in mood from day to day, but always interesting. At times they are excessively shy and retiring, and a person might spend a day in their haunts without seeing or hearing one, although it is safe to say that the intruder had been seen and every foot of his progress noted by the chipmunks. On another day, perhaps because the sun shines more brightly and Nature is in a happier mood, the animals appear on all sides. Their slowly repeated, sociable *chuck, chuck!* is heard from the depths of the brushy covert as well as from the tops of stumps, logs, rocks, or other lookout points where they sit to view their surroundings. If alarmed they utter a sharp, birdlike chirping note as they vanish in the nearest shelter.

As one moves about in their haunts, he may now and then see one appear for a moment above the undergrowth in a tall bush, on top of a stump, and sometimes even mounting a few yards up a tree trunk to observe the cause of the disturbance, but only to vanish quickly.

They are always skirmishing for food, and carrying it in their cheek pouches to hidden stores. On the approach of winter this activity becomes very marked. A surprising variety of fruits and seeds are eaten and stored, among them the salmonberry, red elderberry, black-capped raspberry, thimbleberry, blackberry, blueberry, gooseberry, thistle seed, dogwood seed, hazelnuts, acorns, and others. They have favorite feeding places, such as the top of a stone or stump or the shelter of a log where they carry nuts or other seeds. These places are always marked by little piles of empty shells or chaff.

About ranches they raid grainfields and other crops, sometimes in numbers sufficient to do considerable damage.

In sheltered spots they make underground burrows with nest chamber and storerooms excavated along the passages. They usually retire to these dens to hibernate during the last of September or first of October, and appear again about March or April, often long before the snow disappears.

During fall and early winter they are sometimes seen running about over newly fallen snow. One which was dug from its winter quarters in British Columbia the last of November would move about slowly and sleepily if teased, but when left undisturbed would curl up and go to sleep again.

This indicates the difference between the light and often broken hibernation of chipmunks and the deep lethargy which possesses ground squirrels in the North at this time. Toward the southern end of their ranges neither chipmunks nor ground squirrels hibernate.

They mate soon after they awake from their winter sleep, and the young, two to five or six in number, are born from April to June. Whether more than one litter is born during a season, is, like many other details concerning the lives of these attractive animals, still to be learned.

EASTERN CHIPMUNK: Tamias striatus
and its relatives

(*For illustration, see Color Plate, page* 130)

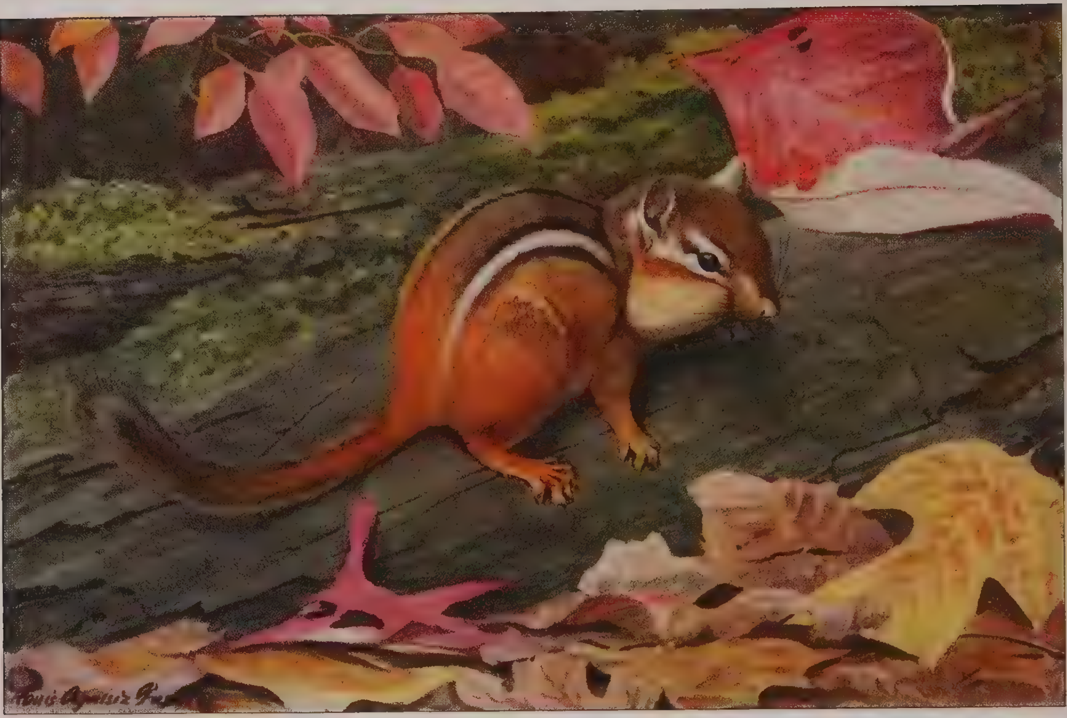
The chipmunks are close relatives of the tree squirrels, but live mainly on the ground, are provided with cheek pouches for carrying food to their hidden stores, and have many ways similar to those of the spermophiles, or ground squirrels. They are nearly circumpolar in distribution, ranging through eastern Europe and northern Asia as well as from the Atlantic to the Pacific in North America. On this continent they are far more numerous in species and individuals than in the Old World, and their center of abundance appears to lie in the mountainous western half of the United States. Their extreme range extends from near the Arctic Circle in Canada to Durango and middle Lower California, Mexico.

As a group, the chipmunks are widely known for their grace, beauty of coloration, and sprightly ways. Among the handsomest and most familiar is the common chipmunk of Canada and the United States east of the Great Plains. Within this area reside several geographic races, the best known of which is the brightly colored animal pictured in the accompanying illustration and occupying all the wooded region from the Great Lakes to Nova Scotia and New England. Its vertical distribution extends from sea level to the summit of Mount Washington, where it may be seen on pleasant summer days.

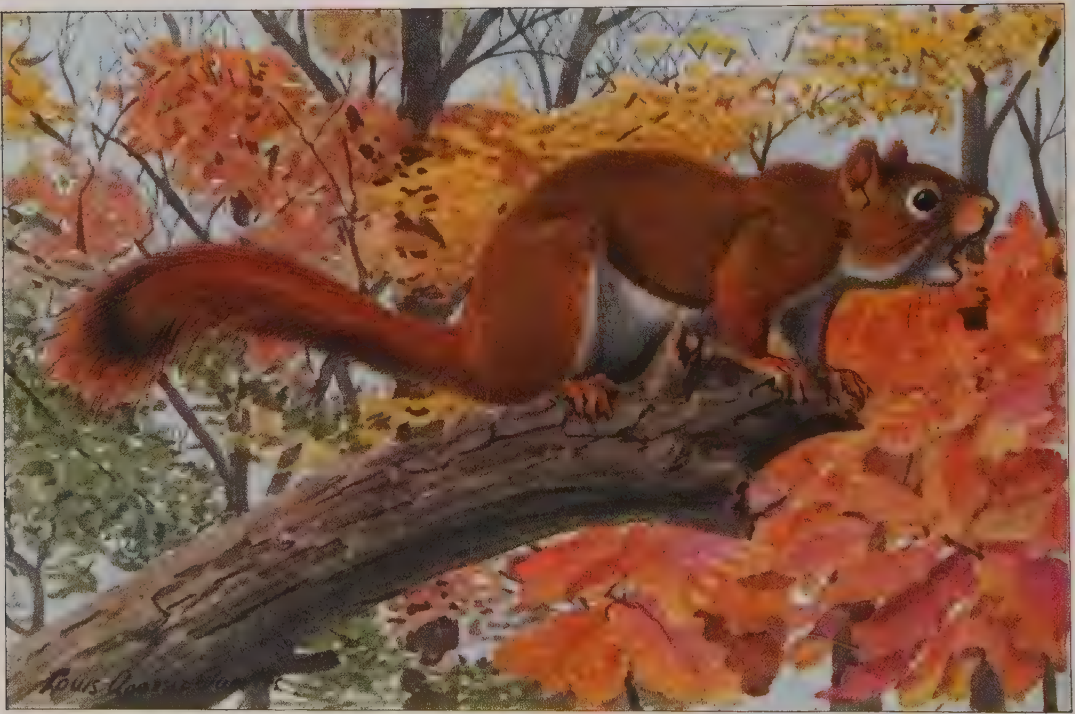
The Eastern chipmunks, like most of their kind, belong to the forest and its immediate environment. Favorite haunts are rocky ledges covered with vines and brush, half-cleared land, the brushy borders of old pasture fences, stone walls, and similar situations. In early days they were so plentiful in places that they made serious inroads on the scanty crops of the settlers, and bounties were offered for their destruction.

No one who visits the woods of the Eastern States or Canada can fail to observe with pleasure the alert, attractive ways of these little squirrel-like animals. They are everywhere, including the vicinity of summer camps in the forest, and, if encouraged, prove most attractive and friendly neighbors. To such small beasts the world is peopled with enemies against which the only safeguard is eternal watchfulness. This accounts for the hesitating advances and retreats so characteristic of these chipmunks, which at the first sudden movement of any suspicious object, or loud noise, disappear like a flash. They soon learn to recognize a friend and in many places come regularly into camp buildings to receive food. I doubt, however, if they ever become quite so friendly as some squirrels under similar conditions.

Like most of the squirrel tribe, they are endowed with much curiosity, and at the appearance of anything unusual, but not too alarming, they seek some safe vantage point from which to peer at it with every sign of interest. They are extremely timid and wary, however, and, if doubtful, move by little cautious runs, stopping



EASTERN CHIPMUNK
Tamias striatus



RED SQUIRREL
Sciurus hudsonicus

to sit up and look about, often mounting a stump, log, or a side of a tree trunk for the purpose, the tail all the time moving with slow undulations. If alarmed, they dash away to the nearest shelter, the tail held nearly or quite erect and sometimes quivering excitedly. When running to shelter, they often utter chattering cries of alarm. Their principal enemies are cats, weasels, martens, foxes, snakes, birds of prey, and the untamed small boy with his dog. Weasels, the supreme terror of their existence, follow them to the depths of their burrows and kill them ruthlessly.

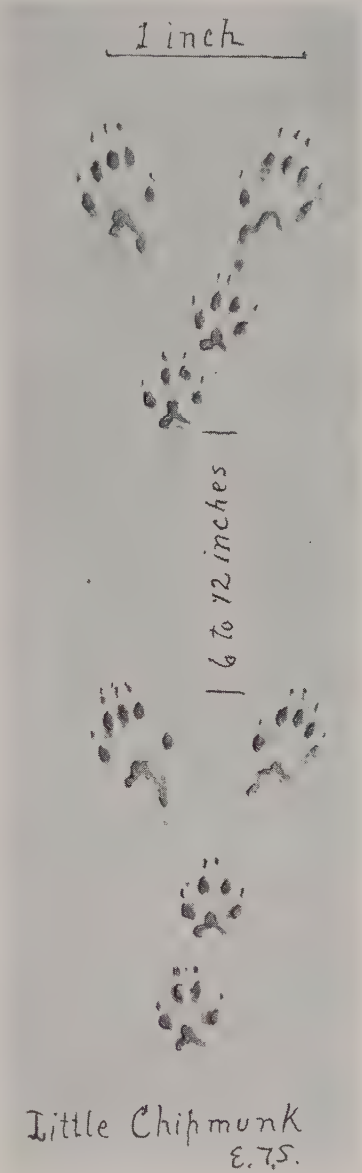
These chipmunks are sociable and playful, often pursuing one another, first one and then the other being the pursuer, as though in a game. They race along fence tops and old logs and up stumps and even the lower parts of tree trunks. Lovers of bright, sunny weather, they usually remain hidden in their burrows during stormy days. If they venture out at such times, they are quiet and show none of the mercurial liveliness which characterizes them when the weather is pleasant.

Their food includes a great variety of cultivated and wild plants, as wheat, buckwheat, corn, grass seed, ragweed seed, hazelnuts, acorns, beechnuts, strawberries, blueberries, wintergreen berries, mushrooms, and many others. In addition, they eat May beetles and other insects and insect larvæ, snails, occasional frogs, salamanders, small snakes, and many young birds and eggs.

At all seasons they fill their cheek pouches with food to be carried away to their dens, but toward the end of summer or early fall they work industriously laying up stores of seeds and nuts. Sometimes these stores, hidden in chambers excavated for the purpose or in hollow logs and similar places, contain several quarts of beechnuts or other nuts or seeds. Small quantities of such food are hidden here and there under the leaves or in shallow pits in the ground. Storerooms in one burrow contained a peck of chestnuts, cherry pits, and dogwood berries, and another had a half bushel of hickory nuts.

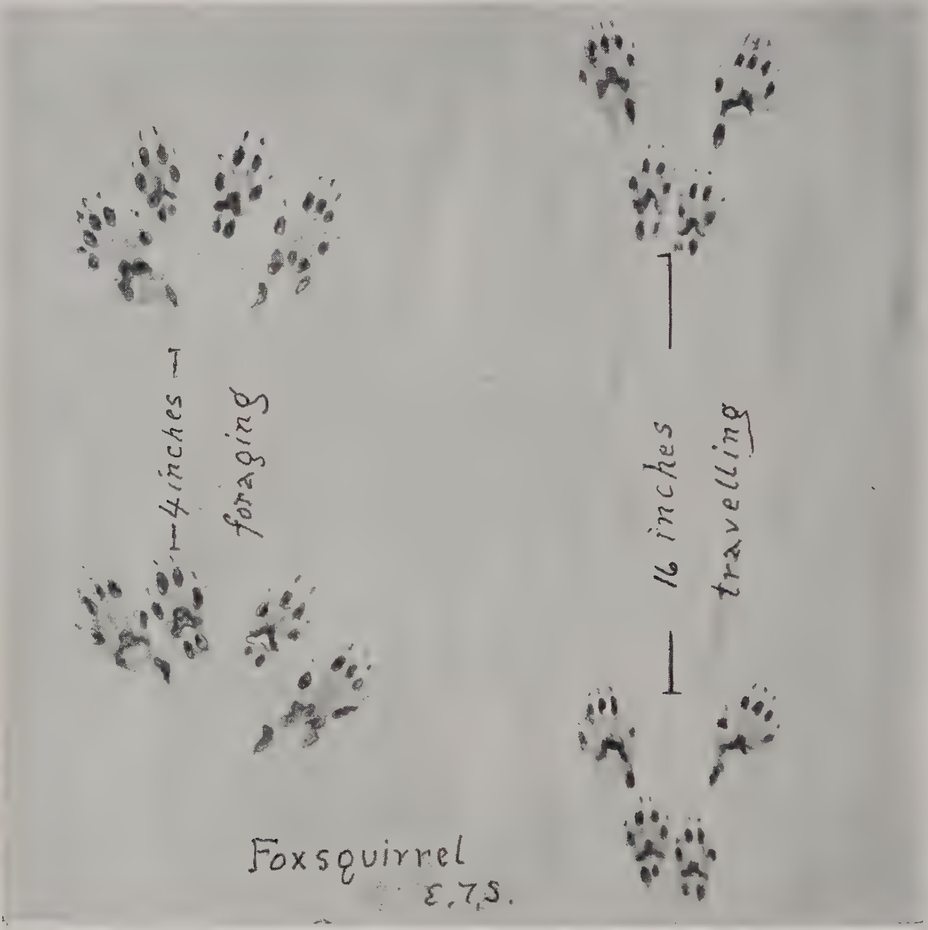
While at a summer camp, I once saw one of these chipmunks give an exhibition of the exquisitely keen power of scent which must be necessary to recover scattered stores. The chipmunk had been coming repeatedly down a wooded slope in full view for 25 yards or more to the floor of the porch for food supplied by the campers. While it was absent carrying food to its burrow, I placed a few nut meats on the flat top of a stump about 15 feet to one side of the porch and farther away than the point where the chipmunk was being fed bread crumbs. On its return several minutes later, instead of going as usual to the porch, it ran directly to the stump, climbed up it, and promptly made off with the nuts, which it had evidently located from afar. They sometimes even climb beeches and other trees to a height of 50 or 60 feet to gather nuts, and are commonly seen on low limbs and in bushes.

The entrances to the burrows are usually under logs, roots, or rocks, or the den may be in a hollow log, stump or base of a tree, or even under a cabin in the woods. The burrows in the ground are commonly a series of tunnels some yards in length, with an oval nest and storage chamber two or three feet underground, and with branches from the main passageway. The nest chamber, a foot or more in diameter, is filled with fragments of dry leaves and other soft vegetable material. One chamber is usually



THE TRAIL OF THE EASTERN CHIPMUNK

The track is much like that of the fox squirrel (see page 132), but usually the forefeet are a little, or quite, one behind the other and, of course, much smaller. No tail mark is ever seen.



THE TRACKS OF A RUSTY FOX SQUIRREL AND FOX SQUIRREL

The exaggerated pads of the squirrel foot are a strong feature of this track. It is typical in the pairing of the forefeet, much more so than that of the gray squirrel. There is never a tail mark in this track.

used for sanitary purposes. The used entrance hole is commonly without a sign of dug earth about it, the loose soil from the burrow and its chambers apparently having been thrown out at another opening, which appears to be used for this purpose only and is kept plugged with earth.

Throughout most of the northern half of its range these chipmunks generally hibernate from some time in October until March. Their hibernation is far less profound than that of the woodchuck and they not infrequently appear above ground during periods of mild weather, even in midwinter. The hibernating period is shorter in the southern part of the range.

They vary much in numbers from year to year and at times appear to increase suddenly in localities where food is plentiful, indicating a probable food migration. The young, numbering from four to six in a litter, are born at varying times between the last of April and late summer, indicating the possibility of more than one litter a season.

The most characteristic note of this chipmunk is a throaty *chuck, chuck!* Ordinarily, it is used as a call note, but in spring it is uttered many times in rapid succession to express the seasonal feeling of joy and well-being, thus taking on the character of a song. Such joyful notes may be heard on every hand in places where the little songsters are numerous. In addition, they have a high-pitched, chirping note and a small churring whistle when much alarmed.

CHAPTER VIII

Tree Squirrels, Flying Squirrels, Pocket Gophers, Pocket Mice, and Kangaroo Rats

THE species discussed in this chapter, like those of Chapter VII, belong to the Order *Rodentia.*

Tree squirrels, Genus *Sciurus,* are among the most attractive of our wild mammals. The abundance, diurnal habits, and sprightly ways of these rodents make them general favorities. Representatives of the genus and closely allied genera occur on all the continents except Australia. North America has many species, some of the most beautiful of which are described in the following pages.

The membrane uniting the front and hind legs, the thin flattened tail, and soft, silky fur distinguish the flying squirrels, Genus *Glaucomys,* from all others of the family. North America has two species, the larger of which, represented by nearly 20 subspecies, occupies the northern and western forested regions from Yukon Territory and Hudson Bay down to eastern Canada, the Northeastern States, and along the mountains to California and Wyoming. The smaller one, described in detail on page 142, has seven or eight subspecies distributed in the eastern United States and southward through Texas and the highlands of Mexico to Guatemala. The ranges of the two species overlap in a broad belt along our Northern States from Minnesota to New England.

POCKET GOPHERS DESTROY CROPS WORTH MILLIONS OF DOLLARS

With the exception of the moles, no other group of American land mammals is so highly specialized for a peculiarly restricted mode of life as the pocket gophers, Family *Geomyidæ.* They include numerous genera and species, all very similar in external form, but varying in size from that of a large mouse to a massively formed animal about the size of a muskrat. They are peculiar to North America, where they range from the coast of the southeastern United States to the Pacific and south to Panama. Their vertical range extends from sea level up to beyond timber-line, above 13,000 feet, on some of the volcanoes of Mexico. The family attains its greatest development in that wonderful region of plains and volcanoes lying about the southern end of the Mexican table-land. In many places, members of this family are exceedingly destructive to crops and fruit trees, the losses making an annual total running into the tens of millions.

The Eastern pocket gophers, Genus *Geomys,* range from the southern coastal States west to Texas and Nebraska, and south to northern Mexico. Seventeen species and geographic races of the genus are known. From the pocket gophers of the western United States belonging to the Genus *Thomomys,* they may be distinguished by a deep groove down the front of the upper incisors, which contrasts with the smooth front of the teeth in that group.

POCKET MICE AND KANGAROO RATS ARE STRICTLY AMERICAN

A strictly American family of mammals, the *Heteromyidæ,* comprising pocket mice and kangaroo rats, consists of small animals mainly restricted to the arid parts of the western United States and Mexico, with a few species extending south to northern South America. All have the front feet and legs disproportionately small, and the hind legs more strongly developed. These characters are most marked in the kangaroo rats, which have the form of pygmy kangaroos. They all have cheek pouches in which they carry seeds and other food to their dens, and all are nocturnal, hiding in burrows by day.

The Genus *Perognathus,* comprising pocket mice, contains the smallest and most delicately built members of the *Heteromyidæ,* the tiny silky pocket mice being much smaller than the common house mouse. The genus contains nearly 100 species and subspecies, which range from Minnesota and west of the Mississippi Valley to the Pacific coast and from parts of southwestern Canada down to the southern end of the Mexican tableland and of Lower California. They belong to the arid region of the continent and more than half the known forms appear within the United States.

Kangaroo rats, Genus *Dipodomys,* have cheek pouches like the pocket mice, but are all much larger than any of those animals. They are characterized by their proportionally smaller front feet and legs and the great development of the hind legs and feet into kangaroolike leaping appendages which, combined with a very long tail, have given rise to their appropriate name. They all have subdued buff or brownish coats above, with a white stripe on the outside of the hips, and white underparts, the shade of color varying with the species.

This distribution of color, its general tints, and the external forms of these animals, very closely counterfeit those of the jerboas, which are also small rodents living in desert parts of the Old World, but structurally very different.

The species and subspecies of kangaroo rats number about 70, living mainly in the arid parts of the western United States, but ranging south to the end of the Mexican table-land and of Lower California.

RED SQUIRREL: Sciurus hudsonicus
and its relatives

(*For illustration, see Color Plate, page* 130)

Every one who has visited the forests of Canada and northeastern United States knows the vivacious, rollicking, and frequently impudent red squirrel. This entertaining little beast, known also as the "pine squirrel" and "chickaree," has little of that woodland shyness so characteristic of most forest animals. It often searches out the human visitor to its haunts and from a low branch or tree trunk sputters, barks, and scolds the intruder, working itself into a frenzy of excitement. This habit, combined with the rusty-red color and small size of the animal, about half that of the gray squirrel, renders its identity unmistakable. It has distinct winter and summer coats, but in both the rusty red prevails. The winter dress is distinguished, however, by small tufts on the ears.

The red squirrel, with its related small species, occupying most of the wooded parts of North America north of Mexico, forms a strongly characterized group with no near kin among the squirrels of the Old World. In its geographic races it ranges through the forests of all Alaska and Canada and south to Idaho, Wyoming, the Dakotas, Wisconsin, northern Indiana, all the Northeastern States to the District of Columbia, and along the Alleghenies to South Carolina. This animal, like the chipmunk, is considered too small for game, although occasionally it is hunted for sport. As a result, its increase or decrease is usually governed by the available food supply, although man interferes locally when it becomes too destructive.

This squirrel shows a strong preference for coniferous forests whether of hemlock, spruce, fir, or pine, but may be common in woods where conifers are few and widely scattered. Although usually diurnal and busily occupied from sunrise until sunset, it sometimes continues its activities during moonlight nights, especially when nuts are ripe and it is time to gather winter stores. During warm, pleasant days in spring and fall, when the nights are cool, it often lies at full length along the tops of large branches during the middle of the day, basking in the grateful warmth of the sun.

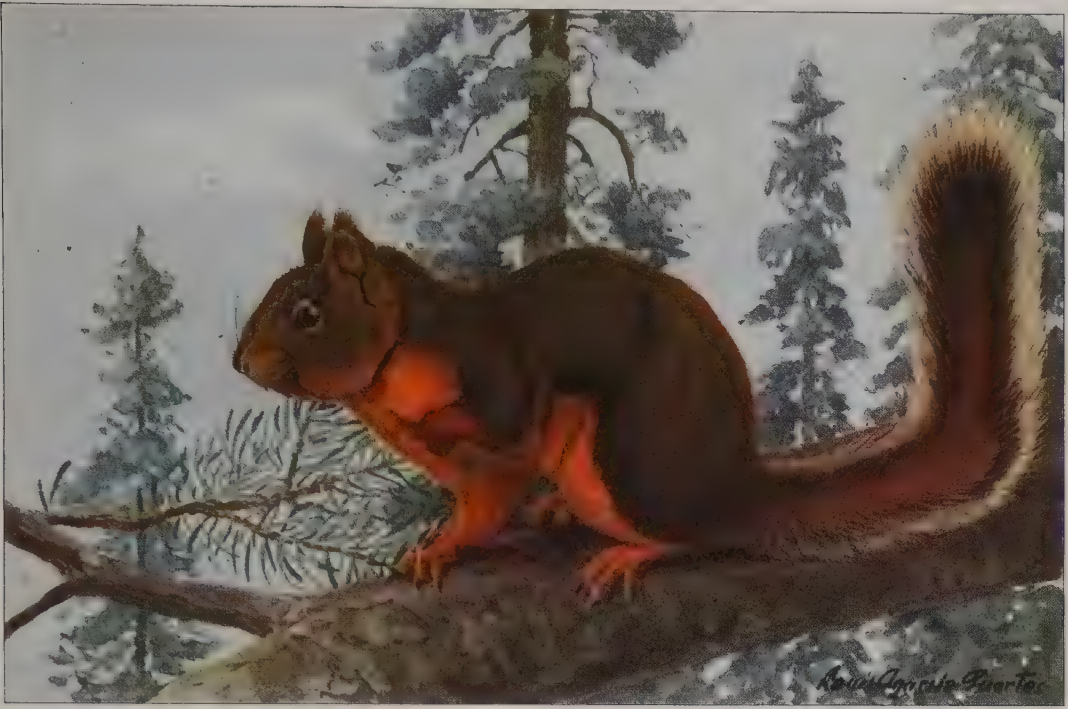
The nests, which are located in a variety of situations, are made of twigs, leaves, or moss, and lined with fibrous bark and other soft material. Some are in knotholes or other hollows in trees, others may be built outside on limbs near the trunk, and still others are in burrows made in the ground under roots, stumps, logs, brush heaps, or other cover offering secure refuge. Apparently several litters of young, containing from four to six, are born each season, as they have been found from April to September.

They do not hibernate, but are active throughout the year, except during some of the coldest and most inclement weather. To provide against the season of scarcity, they accumulate at the base of a tree, under the shelter of a log or other cover, great stores of pine, spruce, or other cones, sometimes in heaps containing from six to ten bushels. They also hide scattered cones here and there and place stores of beechnuts, corn, and other seeds in hollows or underground storerooms. They are fond of edible mushrooms and sometimes lay up half a bushel of them among the branches of trees or bushes to dry for winter use. In the Western mountains their great stores of pine cones are often robbed by seed-gatherers for forestry nurseries. In winter they tunnel through the snow to their hidden stores and sometimes continue the tunnels from one store to another.

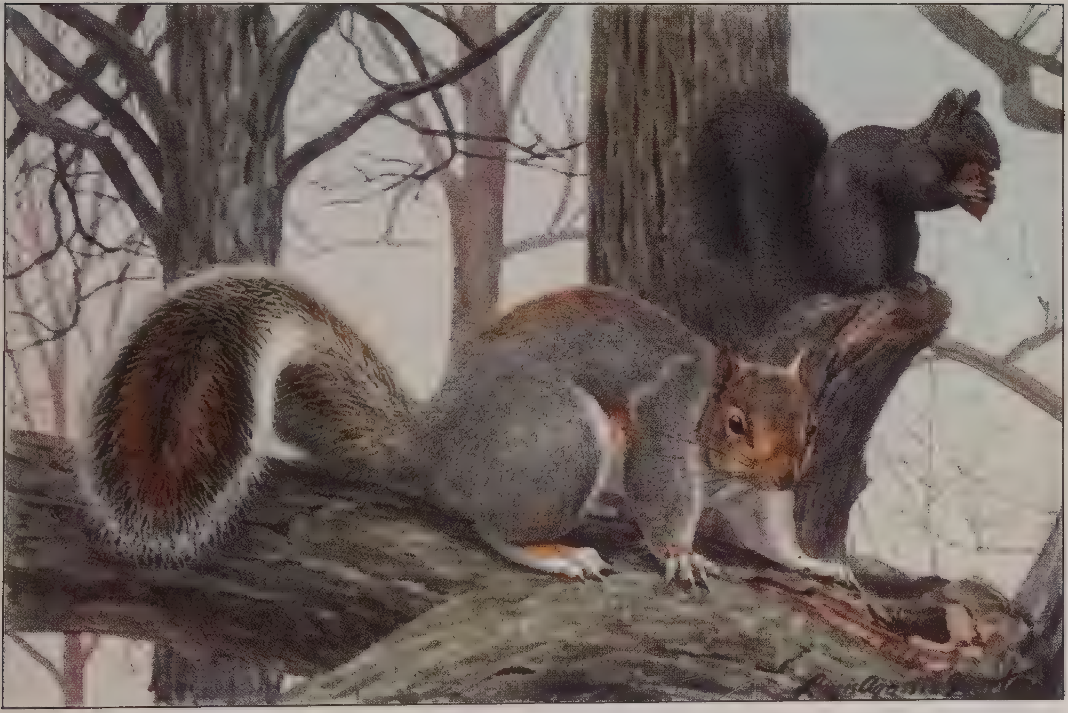
Each squirrel makes its home for a long period in or about a certain tree. There he carries his cones to extract the seeds, and on the ground beneath it the accumulation of fallen scales and centers of cones sometimes amounts to 15 or 20 bushels. In addition to the seeds of the various conifers, red squirrels eat many kinds of fruits and seeds; they also raid cornfields and orchards and even make nests in barns and woodsheds to be near the food supply which some farmer's industry has collected.

Red squirrels have the interesting habit of voluntarily swimming streams and lakes, including such bodies of water as Lake George and even the broadest parts of Lake Champlain. When they thus cross the water and make their migrations, there is little doubt that they are usually in search of a better feeding ground.

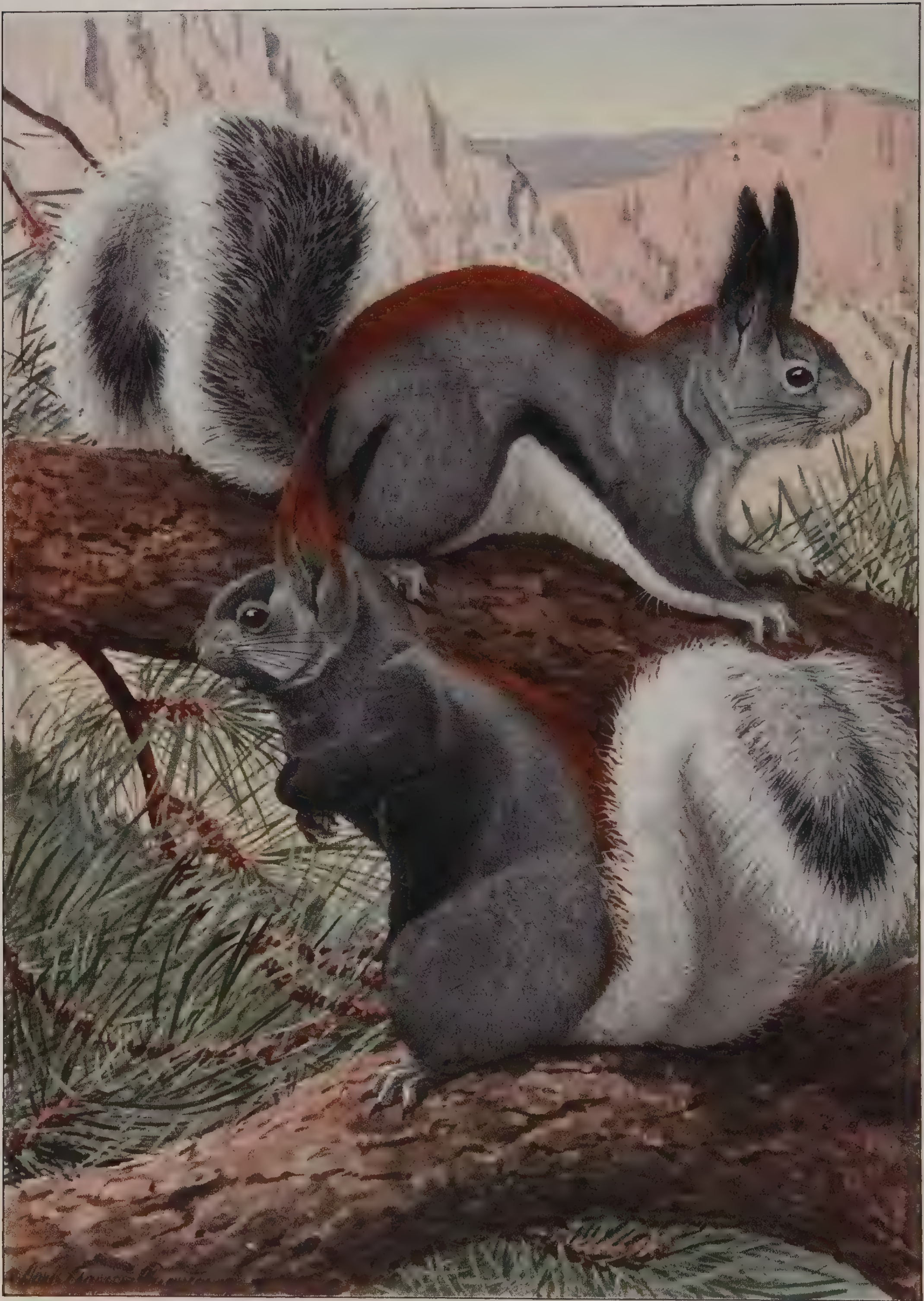
The red squirrels and related species have the greatest variety of notes possessed by any of



DOUGLAS SQUIRREL
Sciurus douglasii



GRAY SQUIRREL (and black phase)
Sciurus carolinensis



ABERT SQUIRREL
Sciurus aberti

KAIBAB SQUIRREL
Sciurus kaibabensis

the American members of the squirrel family. In addition to the barking, scolding, chattering notes already mentioned, they have a real song, which is one of the most attractive of woodland notes. It is a long-drawn series of musical rolling or churring notes, varied at times by cadences and by having a ventriloquial quality rendering it difficult to locate. These notes never fail to awaken pleasurable emotions and to recall to me my early boyhood in the Adirondacks, where the spring songs of the chickarees were among the first calls which awakened me to the marvelous beauties of Nature.

The worst trait of the red squirrel, and one which largely overbalances all his many attractive qualities, is his thoroughly proved habit of eating the eggs and young of small birds. During the breeding season he spends a large part of his time in predatory nest hunting, and the number of useful and beautiful birds he thus destroys must be almost incalculable. The number of red squirrels is very great over the continental area, and one close observer believes each squirrel destroys 200 birds a season. Practically all species of northern warblers, vireos, thrushes, chickadees, nuthatches, and others are numbered among their victims. The notable scarcity of birds in northern forests may be in part due to these handsome but vicious marauders.

In the fur country these squirrels are much disliked by the trappers for their constant interference with meat-baited traps. Many fall victims to their carnivorous desires, but their places are soon taken by others.

The energy and unfailing variety in the performances of red squirrels always keep the attention of their human neighbors. Among other interesting activities, their pursuit of one another up and down and around the trunks of trees, over the ground, along logs, back and forth in the most reckless abandon, is most entertaining to watch. These pursuits among the young are playful and harmless, but among the males in spring are of the most deadly character. I have seen the victim go up and down tree after tree, shrieking in fear and agony and leaving a trail of blood on the snow as he tried to escape his truculent pursuer.

Such scenes as this, combined with our knowledge of its bird-killing habits, appear belied by the exquisite grace and beauty of this squirrel as it sits on a branch and sends its musical cadences trilling through the primeval forest. So confirmed are red squirrels in the destruction of bird life, however, that they should not be permitted to become very numerous anywhere, and it may eventually become necessary to outlaw them wherever found in protected areas.

DOUGLAS SQUIRREL: Sciurus douglasii and its relatives

(*For illustration, see Color Plate, page* 135)

In all details of size, form, notes, and habits the Douglas squirrel gives testimony to its descent from the same ancestral stock as the common red squirrel (*Sciurus hudsonicus*). The typical Douglas squirrel, represented in the accompanying illustration, is one of several geographic races of a species which ranges from the Cascades and Sierra Nevada to the Pacific, and from British Columbia south to the San Pedro Martir Mountains of Lower California. The home of the Douglas squirrel is amid the wonderful coniferous forests of western Oregon, Washington, and southern British Columbia. As in other mammals of this extremely humid region, the colors of its upperparts are dark brown, in strong contrast to the much paler and grayer colors of the closely related subspecies living in the clearer and more arid climate of the Sierra Nevada in California. These squirrels are known locally by a variety of common names, including "pine squirrel," "redwood squirrel," and "drummer."

Although usually not quite so noisy and self-assertive as the irrepressible little red blusterer of Eastern forests, the Douglas squirrel is also notable for its rollicking, chattering character and sometimes cannot be outdone in its amusing displays of aggressive impudence. When the animals are numerous, the air at times resounds with their call notes or songs, one answering the other, now near and now far, until the somber depths of the mighty forest seems peopled with a multitude of these joyous furry sprites. Their song, resembling that of the red squirrel, is a rapid trilling or bubbling series of notes, long drawn out and sometimes varied by cadences. It is so musical that it seems more like the song of some strange bird than of a mammal. When these squirrels are not common, they are much less given to song and seem subdued and shy, as though impressed by the vast loneliness of their deep forest haunts.

At mating time, early in spring, they are especially noisy, and again in summer when the first litter of young are out trying their youthful pipes in expression of their cheerful well-being. They frequently come down on a low branch or on the trunk of a tree and chatter, bark, and scold at man, dog, or other intruder, now rushing up and down, or making little dashes around the tree trunk, their necks outstretched and tails flirting with a great show of anger and contempt highly entertaining to see. They are restlessly active at all seasons of the year and habitually chase one another through the forest with an appearance of rollicking fun which may many times be in more deadly earnest than appears to the casual observer.

In winter their tracks in the snow lead from tree to tree, along the tops of logs and fences, and in all directions to hidden stores of food, which they appear to be able to locate with unerring certainty under the snow. An adventurous spirit leads them to race away from the forest, along fence-tops, to pay visits to ranch buildings and even to villages and small towns. Like their Eastern relative, the Douglas squirrels are omnivorous, feeding on the seeds of all the conifers in their range, including spruces, firs, pines, and redwoods, and also upon acorns, and a great variety of other seeds, fruits, and mushrooms, insects, birds' eggs, young birds, and any other meat they can find.

Because of their habit of interfering with meat-baited traps, they are a nuisance to trappers. They frequently visit orchards and carry off apples and pears, from which they extract the seeds. They have been seen also to visit the wounds made on a willow trunk by sapsuckers to drink the flowing sap. Their feet and the fur about their mouths are often much gummed with pitch from working on pine cones.

In many places the soft, moist earth in the woods is riddled with little pits dug by these squirrels, apparently when they are after larvæ or perhaps edible roots or seeds. Throughout the summer, but especially during the last half of the season, and in autumn, Douglas squirrels work with persistent energy to amass great stores of seed-bearing cones, which they heap, sometimes bushels of them, about the bases of trees, stumps, and the upturned roots of fallen trees or under other shelter.

Cones are also buried here and there in the loose leaves and humus. In winter many holes in the snow with piles of cone scales at the entrances show where the owners have dug down to their stores.

Some of their nests are constructed in hollow trees, many others on branches near their junction with the trunks, and still others in subterranean dens under roots, logs, or stumps. In winter when alarmed these squirrels sometimes race down the tree trunks and take refuge in holes leading through the snow to their food caches and underground burrows.

The nests built in tree-tops are usually rather bulky, measuring a foot or more in diameter, and are made of small twigs, dry leaves, moss, grass, and fibrous bark. They are commonly lined with such soft material as feathers and fur. The young, which number three to seven in a litter, are born at any time between April and October.

The extraordinary intelligence and sense of prevision possessed by squirrels of this group are well illustrated by certain local food migrations. These have been observed in eastern Oregon in years when the cone crop has failed and nothing was available to lay up for winter. Under such conditions, to remain in the mountain forests would mean death by starvation before winter had fairly begun.

In 1910 and 1913 failure of the cone crop occurred in eastern Oregon and these squirrels promptly left the mountain forests in September and descended along creek courses to the open sagebrush plains as much as seven or more miles from the border of their ordinary haunts. In this open country they wintered successfully, raiding the farmers' grain bins, root cellars, and other stores, and otherwise showing their supreme fitness to survive in the struggle for existence. With the coming again of summer, they promptly returned to their abandoned homes in the pines.

It appears to be one of the marvels of animal intelligence that under such circumstances as those named above, the entire body of the squirrels on the mountains should have known what to do, especially as a great percentage of their number could never have had any previous experience as guides.

GRAY SQUIRREL: Sciurus carolinensis
and its relatives

(*For illustration, see Color Plate, page* 135)

The gray squirrel is so well known to everyone in the Eastern States that it scarcely needs an introduction. Many who have not seen it in its native haunts are familiar with it as a graceful and charming resident of parks in numerous cities. It is about twice as large as the red squirrel and intermediate in size between that species and the fox squirrel. Although sharing some of the range of both the species named, the color of the gray squirrel at once distinguishes it.

It is a North American species with no near relative in the Old World; on the Pacific coast, in the mountains of the Southwest, and in Mexico are other squirrels having much the same gray-colored body, but with no close relationship to it. Its range covers the deciduous forests of the Eastern States and southern Canada from Nova Scotia to Florida, and westward to the border of the treeless Great Plains. Wherever they occur, these squirrels are an attractive element in the woodland life, their barking and chattering, their graceful forms, and their activity adding greatly to the cheerful animation of the forest. They are far less vociferous than red squirrels, but their notes are varied and serve to express a variety of meanings.

During the early settlement of the country west of the States bordering the coast, gray squirrels existed in great numbers and often made ruinous inroads on the pioneer corn and wheatfields. In 1749 they invaded Pennsylvania in such hosts that a bounty of threepence each was put on their scalps. Eight thousand pounds sterling was paid on this account, which involved the killing of 640,000 squirrels. In 1808 a law in force in Ohio required that each free white male deliver 100 squirrel scalps a year or pay $3 in cash. Records of the ravages of these squirrels in cornfields are extant also from Kentucky, Missouri, and other States.

Enormous migrations of gray squirrels from one part of the country to another occurred in those days, caused apparently by the failure of food supplies in the deserted areas. Some impulse to move in one general direction at the same time appeared to affect the squirrels and they swarmed cross-country in amazing numbers, carrying devastation to any farms visited on the way. When engaged in such movements they appeared indifferent to obstacles and without hesitation swam lakes and streams even as large as the Hudson and the Ohio. Amusing legends grew up concerning these migrations, one of which avers that when the squirrels arrived on a river bank, each dragged a large chip or piece of bark into the water and, mounting it, raised its bushy tail in the breeze and was wafted safely to the other shore! As a fact, many were drowned in crossing large streams and others arrived exhausted from their exertions.

The gray and fox squirrels were favorite targets for pioneer marksmen. The early chronicles tell of the ability of Daniel Boone and other riflemen to "bark" a squirrel, which meant so to cut the bark of the branch on which the squirrel sat, that, without hitting the animal, it was brought to the ground stunned. With the clearing away of the forests, the general occupation of the country, and the decrease of larger animals, gray squirrels have been deprived of most of their haunts and have become such desirable game that they have decreased to a point requiring stringent legal protection to save them from extermination.

Gray squirrels are almost as thoroughly arboreal as red squirrels and make their nests either in hollow trunks or build them in the tops of trees. These outside nests are common and much like a crow's nest in appearance, except that they are generally more bulky and show more dead leaves. They are built on a foundation of small sticks with a rounded top of leaves, and are lined with shreds of bark, moss, and similar soft material. In the extreme northern part of their range they live mainly in hollow trees, but farther south many winter in outside nests. During severe cold and in stormy weather they remain hidden, somtimes for days at a time.

They have two litters of four to six young a year, the first usually being born in March or April. The old squirrel is a devoted mother and if the nest is disturbed she will at once carry the young to some safer retreat.

In many parts of their range, black, or melanistic individuals are born in litters otherwise of the ordinary gray color. In some districts the number of the black squirrels equals or exceeds the gray ones.

Gray squirrels range through such a variety of climatic conditions that their food varies greatly. They eat practically all available nuts, including acorns, chestnuts, beechnuts, hickory nuts, and pecans, besides numberless seeds, many small fruits, and mushrooms. They raid fields for corn and wheat, and steal apples, pears, and quinces from orchards to eat the seeds. Like most other small rodents, they are fond of larvæ and insects and also destroy many birds' eggs and young birds. They are far less serious offenders, however, in destroying birds than the red squirrel.

On the approach of winter they lay up stores of seeds and nuts in holes of trees and in little hiding places on the ground. Many nuts are hidden away singly. In the public parks of Washington, where many gray squirrels exist, I have repeatedly seen them dig a little pit two or three inches deep, then push a nut well down it, cover it with earth, which they press firmly in place with the front feet, and then pull loose grass over the spot. One squirrel will have many such hidden nuts, and, with nothing to mark the location, it appears impossible that they could be recovered. That the squirrels knew what they were doing I have had repeated evidence in winter, even with several inches of snow on the ground, when they have been seen to sniff along the top of the snow, then suddenly to stop, dig down and unearth a nut with a precision that demonstrates the marvelous accuracy of their sense of smell. Although mainly diurnal, they are sometimes abroad on moonlight nights, especially when gathering stores of food for winter.

Wherever they are, these squirrels are extremely graceful. They move along the ground by curving bounds, the long fluffy tail undulating as they go, or run through the tree-tops, leaping from branch to branch with an ease and certainty beautiful to see. When pressed, they make amazing leaps from tree to tree or even from a high tree-top to the ground without injury. They are extremely cunning at concealing themselves by lying flat on top of branches or by gliding around tree trunks, keeping them interposed between themselves and the pursuer.

Gray squirrels are so responsive to protection that they may continue to grace our remaining forests if we properly guard them. In addition to their beauty they are interesting game animals which should continue to afford a moderate amount of sport—sufficient to prevent them from becoming overabundant and destructive. Now introduced in many city parks throughout the United States and in parts of England, including London, their ready acceptance of people as friends renders them charming animals in such places; but natural food is so scarce under these artificial conditions that care must be taken to feed them at all seasons, especially in winter.

ABERT SQUIRREL: Sciurus aberti and its subspecies

KAIBAB SQUIRREL: Sciurus kaibabensis

(*For illustrations, see Color Plate, page* 136)

Among the many kinds of squirrels which lend animation and charm to the forests of North and South America, none equal in beauty the subjects of this sketch—the Abert and the Kaibab squirrels. These are the only American squirrels endowed with conspicuous ear tufts, which character they share with the squirrels occupying forests in the northern parts of the Old World from England to Japan. In weight they about equal a large gray squirrel, but are shorter and distinctly more heavily proportioned, with broader and more feathery tails.

Their range covers the pine-forested region of the southern Rocky Mountains in the United States and the Sierra Madre of western Mexico. The Abert squirrel, with its several subspecies, is the more widely distributed, being found from northern Colorado south through New Mexico, Arizona, Chihuahua, and Durango. The Kaibab squirrel, which is even more beautiful than its relative, shows marked differences in appearance and yet is evidently derived from the same species.

The typical Abert squirrel lives in the pine forests along the southern rim of the Grand Canyon in northern Arizona, and the Kaibab squirrel lives in the pines visible on the northern rim of the canyon, less than 15 miles away. It is confined to an islandlike area of pine forest about 70 miles long by 35 miles wide, on the north side of the canyon, on the Kaibab and Powell plateaus, directly across from the end of the railroad at the Grand Canyon Hotel. The two species live under practically identical conditions as to vegetation and climate.

In these sketches of our mammal life I have repeatedly noted the effect of changing environment in modifying the animals subject to it. In the present case, the change in the squirrels on the north side of the Grand Canyon has evidently been brought about by that powerful factor in evolution known as "isolation." Cut off from their fellows by the deepening canyon of the Colorado, Kaibab squirrels have occupied a forest island ever since, with the resulting change in characters now in evidence.

The home of both the Abert and the Kaibab squirrels is almost entirely between 6,000 and 9,500 feet altitude, on the mountain slopes and high plateaus overgrown with a splendid open forest of yellow pine mixed in many places with firs and aspens. Occasionally, as food becomes scarce in their ordinary haunts, they range up into the firs or down into the oaks and piñon pines. In winter their haunts are buried in snow, but in summer they present on every hand lovely vistas among the massive tree trunks, varied here and there by gemlike parks. Everywhere the ground is covered with grasses and multitudes of flowering plants. In the wilder parts of this fascinating wilderness roam bears, mountain lions, wolves, deer, and wild turkeys, and only a few decades ago still wilder men, belonging to some of our most dreaded Indian tribes.

Although these squirrels commonly make use of large knotholes or other hollows in trees, they regularly build high up in the branches bulky nests of leaves, pine needles, and twigs, and line them with soft grass and shredded bark. Sometimes several full-grown squirrels may be found occupying one of these outside nests, probably members of one family. They are active throughout the year, but remain in their nests during storms and severe winter weather. In northern Arizona I have known them to stay under cover for a week or two at a time in midwinter.

The young appear to be born at varying times between April and September. Although not definitely known, it seems probable that they have two litters of from three to four young each season.

The seeds and the tender bark from the terminal twigs of the Western yellow pine (*Pinus ponderosa*) furnish their principal food supply. During periods when pine seeds are not available, the squirrels cut the ends of pine twigs, letting the terminal part bearing the leaves fall to the ground, while the stem, several inches in length, is stripped of bark. Often at times of food scarcity the bark will be eaten for a considerable distance along the outer branches, almost like the work of porcupines. The ground under the pines where the squirrels are at work sometimes is almost covered with the freshly dropped tips of branches.

The Abert squirrels also eat the seeds of Douglas spruce, of the piñon pine, acorns, many seeds, roots, green vegetation, mushrooms, birds' eggs, and young birds. Now and then they rob cornfields planted in clearings, but they do little damage to crops. Some years they are extremely numerous and are in evidence everywhere; again they become scarce and so wary that it is difficult to see one, even where its fresh workings are in evidence.

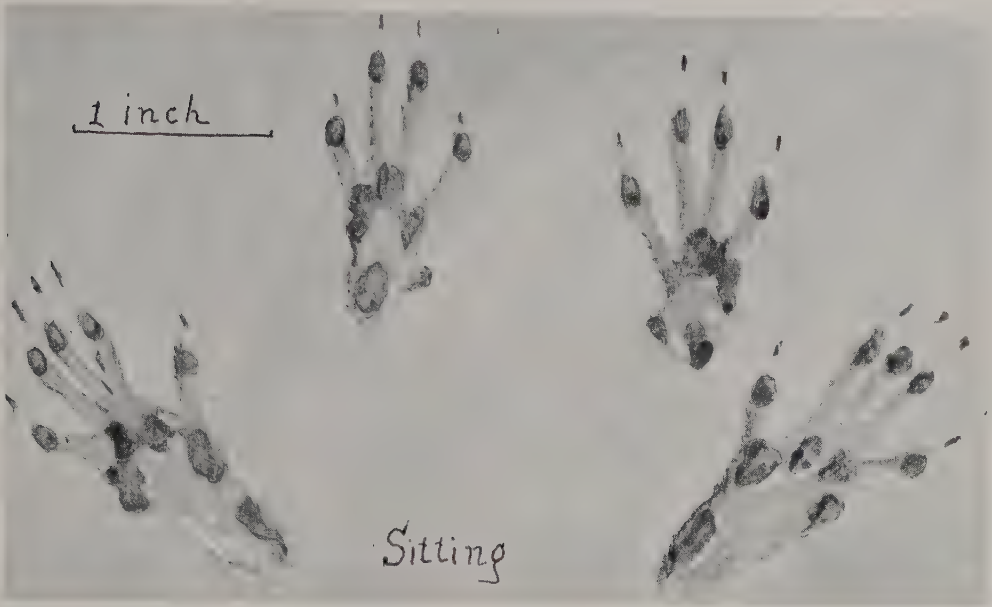
Both these squirrels have a deep churring or chucking call, sometimes becoming a barking note resembling that of the fox squirrel. They also have a variety of chattering and scolding notes when excited or angry. At times they become almost as aggressive as the red squirrel and come down the tree trunk or to a lower branch, whence they scold and berate the object of their disapproval.

When much alarmed, they are expert at hiding among tufts of leaves near the ends of branches, on tops of large limbs, or behind trunks. They will remain hidden in this way for an hour or more, patiently waiting for the danger to disappear, but one is often betrayed by the wind blowing the feathery tip of its tail into view.

On the ground the tail is usually carried upraised in graceful curves. Here these squirrels spend much time among fallen cones and in digging for roots and other food. When they walk they have an awkward waddling gait, but when they are alarmed, or desire to move more rapidly for any cause, they progress in a series of extremely graceful bounds, which show the plumelike tail to good advantage. When the Kaibab squirrel is moving about on the ground, its great white tail is extraordinarily conspicuous in the sunshine. This repeatedly drew my attention to these squirrels, even at such long distances that they would otherwise have been overlooked.

Although so heavily built, these squirrels are adept in leaping from branch to branch and from tree to tree. On one occasion a branch on which an Abert squirrel was standing near the top of a pine tree was struck by a rifle ball; the squirrel promptly ran to the end of a large branch about 50 feet from the ground, and although no tree was anywhere near on that side, it leaped straight out into the air, with its legs outspread just as would a flying squirrel. It came down in a horizontal position and struck the ground flat on its under side and the rebound raised it several inches. Without an instant's delay it was running at full speed across a little open park and disappeared in the forest on the other side. I was standing only a few yards to one side of the falling squirrel and the widely spread feet and legs were perfectly outlined against the sky. It was evident that this squirrel and probably all of its kind appreciate the fact that such an attitude will help break the force of the descent. This suggested the possibility of a similar habit having influenced the origin of the flying squirrel's membranes.

One summer day in the Sierra Madre of western Durango I sat on a mountain slope watching for game. Below me stood the hollow-topped stub of an oak, the top being on a level with my eyes and about 20 yards away. Soon after I arrived, the heads of four half-grown squirrels of the Abert family appeared in a row at the upper border of the opening, their bright eyes turning on all sides. Suddenly a hawk glided by, one of its wing tips almost



A FULL-SIZE RENDERING OF A FOX-SQUIRREL TRACK

The arrangement of this track when the animal is foraging and traveling is shown on page 132.

brushing the noses of the squirrels. Instantly they vanished from sight and a noise of scratching and frightened chattering continued for several minutes, as though they were burying themselves under the nest. About 20 minutes later the boldest of the family showed the tip of his nose at an opening in a hollow branch near the top of the stub, but it required another ten minutes for him to put forth his head. Finally, becoming confident that no danger threatened, he came out on the limb and deliberately stretched himself, yawning as widely as his little mouth would permit, after which he flirted his tail and frisked over to the trunk of the stub, where he began frolicking about with all the abandon of a kitten at play. When I departed, his more timorous companions were still peering fearfully out of the hole, anticipating the return of the dreaded hawk.

FOX SQUIRREL: Sciurus niger and its subspecies

RUSTY FOX SQUIRREL: Sciurus niger rufiventer

(*For illustrations, see Color Plate, page* 145)

Three species of tree squirrels inhabit the varied forests of eastern North America, each having its marked individuality expressed in color, size, and habits. All occupy a wide territory with varying climatic conditions, to which each species has responded by becoming modified into a series of geographic races, or subspecies. The red and the gray squirrels have already been described and it remains to give an account of the largest and in some respects the most remarkable of the three, the fox squirrel.

No other species of North American mammal can show such an extraordinary contrast in color among its subspecies as that between the rusty-yellowish animal of the Ohio and upper Mississippi Valleys, and the handsome blackish one of the Southeastern States.

Fox squirrels are not only distinguished from gray squirrels by their color, but are also nearly twice their size, commonly attaining a weight of two and sometimes nearly three pounds. They are the strongest and most heavily proportioned of all American squirrels. A deliberation of movement suited to heaviness of body is in marked contrast to the graceful agility of most other tree squirrels. On the ground they walk with a curiously awkward, waddling gait, and even when hard pressed they climb trees with none of the dashing quickness shown by other species. They often move about on the ground by a series of bounds, and at such times, with broad feathery tails undulating in the air, they present a most graceful and attractive sight.

The distribution of the fox squirrel is limited to the forested parts of the Eastern States. There it ranges from the Atlantic coast to the border of the Great Plains, and from southern New York and the upper Mississippi Valley southward to Florida, the Gulf coast, and across the lower Rio Grande into extreme northeastern Mexico.

Variations in the character of the haunts of the different subspecies of this squirrel almost equal their differences in color. In the upper Mississippi and Ohio Valleys the rusty-colored race frequents the upland woods, where the nut-bearing hickory trees characterize the forests. In the South the dark-colored squirrels have more varied homes, living amid the moss-draped live oaks, in the mysterious cypress forests of the swamps, or on the pine-grown uplands.

In early days fox squirrels were plentiful, but never equaled the numbers of the gray squirrel. They appear always to have been more closely attached to their own district, for we have no records of the great migrations so notable in the other species.

Fox and gray squirrels occupy the same districts throughout most of their ranges, but often become so segregated locally that the grays may be found almost exclusively along bottom lands and the fox squirrels on the higher ridges. However, there is no hard and fast separation of haunts and the two forms usually share the same woodlands.

Much time is spent by fox squirrels on the ground searching for food. When danger approaches, in place of promptly taking refuge in a tree, as is a common habit with most tree squirrels, they retreat along the ground, mounting a stump or log now and then to look back at a suspected intruder whose footsteps they can hear at a long distance. If the hunter is without a dog they may run away and be lost. A dog soon forces them up a tree, and if a knothole or other hollow is available, they at once take refuge in it. Otherwise, they hide skillfully in bunches of leaves high in the top or lie flat on a limb or against the trunk, slyly moving to keep on the opposite side as the hunter draws near. In the Mississippi Valley during the crisp days when the hickory nuts are falling and the trees are decked in all the glories of autumn foliage, few sports afield yield more pleasurable sensations than fox-squirrel hunting.

The fox squirrels become fatter than most of their kind and their flesh is not so dry, although all furnish appetizing meat. Their size and the quality of their flesh make them such desirable game animals that, with the constantly growing number of hunters and the destruction of forests, they have already disappeared from large areas where they were formerly abundant. Now they are in real danger of extermination over greater areas in the not-distant future. They are among the most notable and attractive of the forest animals in the Eastern States, and before it is too late every effort should be made to protect them from overshooting. With reasonable conservation they will continue to thrive and keep some of the old-time primitive spirit in our woods. Formerly they had the same predilection as the gray squirrel for the farmers' cornfields and were under the ban, but their numbers are now so reduced that they give little trouble in this way. In some city parks where they have been introduced they soon become tame and do well, except that in losing their fear of man they become subject to many accidents.

Fox squirrels, like many others of their kind, have homes both in knotholes or other hollows in tree trunks, and in bulky nests of sticks and leaves high up among the branches. Both kinds of nesting places are often located in the same tree, the owner living in the outside nest in warm weather and retiring to the shelter of the hollow trunk in severe weather or to escape an enemy. The young, two to four in number, are usually born in March or April, and it is not definitely known whether there is a second litter. These squirrels have a barking call as well as several other rather deep-toned chucking notes.

They are as omnivorous as any of their kind, eating many kinds of nuts, seeds, fruits, mushrooms, insects, birds, birds' eggs, and other flesh food when available. The principal nuts in their haunts are hickory nuts, beechnuts, walnuts, pecan nuts, and the seeds of pines and cypresses. Toward the end of summer and in fall they work busily gathering and storing food for winter in hollow trees, in old logs, about the roots of trees, and in any other snug place where it may be kept safely until needed. Many single nuts are buried here and there in little pits three or four inches deep dug in the soft surface of the earth under the trees. These scattered stores are located when needed by the acute sense of smell which the owners possess.

EASTERN FLYING SQUIRREL: **Glaucomys volans** and its relatives

(For illustration, see Color Plate, page 145)

No one can see one of our small flying squirrels in life without being charmed by its delicate grace of form and velvety fur, nor fail to note the large black eyes which give it a pleasing air of lively intelligence. Flying squirrels are distinguished from all other members of the squirrel family by extensions of the skin along the sides, which unite the front and hind legs, so that when the animal leaps from some elevated point with legs outspread, the membrane and the underside of the body present a broad, flat surface to the air. This enables it to glide swiftly down in a diagonal course toward a tree trunk or other vertical surface on which it desires to alight. It is able to control its movements and to turn with ease to one side or the other, or upward before alighting. When gliding down a wooded hillside or through thick growths of timber, it is thus able to avoid obstacles and alight on the desired place.

Flying squirrels are circumpolar in distribution. In the Old World they occupy forested areas in eastern Europe, and nearly all of Asia. In the New World they are peculiar to North America, where they frequent nearly all the wooded parts from the Arctic Circle to the forests in Mexico along the eastern border of the table-land as well as south through Chiapas into Guatemala. In Asia, the center of development of these interesting rodents, many extraordinary forms occur. Some are giants of their kind, measuring nearly four feet in total length. In America there are two groups of species, the smaller and better known of which, the subject of this sketch, occupies the eastern United States and southward. The Northern and Western animals are larger, some of them more than twice the weight of the Eastern species.

In many parts of the United States, flying squirrels are common and even abundant, but their habits are so strictly nocturnal that they are infrequently seen. They make their homes in woodpecker holes, knotholes, and hollows in limbs, and trunks of trees and stubs. In addition, they take possession of many odd places for residence, among which may be mentioned bird-boxes, dovecotes, attics, cupboards, boxes, and other nooks in occupied or unoccupied houses that are located within or at the borders of woods.

They also make nests of leaves, lining them with fine fibrous bark, grass, moss, fur, or other soft material placed securely in the branches or in forks in trees. They often remodel old bird or squirrel nests into snug homes for themselves. The size and construction of these outside nests vary according to the locality and the material available.

As a rule, the nests are small and accommodate only a single pair with their young. Sometimes they hold only a single individual, but numerous exceptions to this have been observed. In southern Illinois 50 flying squirrels were discovered in one nest in a hollow tree; in Indiana 15 were found in a hollow stump; and near Philadelphia 30 were evicted from a martin box they had usurped.

In the southern part of their range, flying squirrels are active throughout the year, but in the North they become more or less sluggish, if they do not actually reach the stage of real hibernation during the severest weather.

Their food is extremely varied and includes whatever nuts grow in their haunts, as beechnuts, pecans, acorns, and others, with many kinds of seeds, including corn gathered in the field, and buds and fruits of many kinds. They also eat many insects, larvæ, birds and their eggs, and meat. Taking advantage of their known liking for bird flesh, they may frequently be caught by concealing a trap on top of a log in the woods and scattering bird feathers over and about it. Trappers for marten and other forest fur bearers are much annoyed in winter by the persistence with which the flying squirrels search out their traps and become caught in them, thus forestalling a more valued capture. Trappers in Montana who run long lines of traps for marten through the mountain forests capture hundreds of these squirrels in a single season.

Flying squirrels have several notes, one of which is an ordinary *chuck, chuck* much like that of other squirrels. They also utter sharp squeaks and squeals when angry or much alarmed, and a clear musical chirping note, birdlike in character, which is frequently repeated for several minutes in succession and is undoubtedly a song.

These beautiful little animals become the most delightful of pets, as they are notable for extraordinary playfulness and a readiness to accept man as a friend. Many interesting accounts have been published concerning the affectionate attachment they form for their human hosts and the amusing and tireless activity they show at night. By day they remain sound asleep, rolled up in a furry ball in some dark corner.

They are known to have a litter of from two to six young in April, and young are born at various times throughout the summer, but it is still unsettled whether there is more than one litter a year. The mother is devoted to the young, and if driven from them will keep close by at the risk of her life, showing much anxiety and readiness to do what she can to protect them. One instance well illustrates this maternal care. From a nest in a hollow stub the helpless young were taken and placed on the ground at its base, while the despoiler of the home stood by to observe the result. The mother soon returned and not finding her family in the nest promptly located them on the ground. Quickly descending, she took one in her mouth, carried it to the top of the stub and, launching into the air, sailed to a tree 30 feet away, up which she carried her baby and placed it safely in a knothole. The trip was quickly repeated until the family was reunited in its new location.

At night the curiosity of flying squirrels about strange things and their mischievous activities are often most entertaining, and sometimes exasperating. Whatever is accessible within their territory is certain to be thoroughly explored. A large apartment building, seven stories high, in Washington, D. C., stands near the border of the woods in the Zoölogical Park. During one summer night a friend occupying an apartment on the top floor of this building, fronting the park, observed some movement on one of his window sills and by later observation and by inquiry among the other residents, he learned that flying squirrels were habitually climbing all about the high walls to the top of this building, using it and some of the rooms as a nightly playground. Several occupants of apartments in different parts of the building regularly placed nuts of various kinds on the window ledges for them, and now and then were amused to find that during the night the squirrels had carried away some of their nuts, but had replaced them with other kinds, sometimes brought from a window at a considerable distance on another side of the building. The presence of these squirrels was warmly welcomed and furnished much interest to their hosts.

The constant activity of these little animals at night enables owls and cats to capture many, but their small size and the shelter of their homes by day will prevent their serious decrease in numbers so long as suitable forests remain to supply their needs.

MISSISSIPPI VALLEY POCKET GOPHER: Geomys bursarius and its relatives

(*For illustration, see Color Plate, page* 146)

Without exception pocket gophers are powerfully built for their size, the head and front half of the body being extraordinarily muscled to meet the demands of their mode of life. The broad, blunt head is joined to the body by a short, powerfully made neck. The eyes are small and have the restricted vision to be expected from animals living underground. The ears are reduced to little fleshy rims about the openings, and the short, naked tail is provided with nerves which render it useful as an organ of touch.

The front teeth are broad, cutting chisels, and on each side of the mouth is a large pocket in the skin used for gathering and carrying food. On the front feet are long claws, which, when not being used to dig or handle earth, are doubled under against the soles of the feet, so that the gopher walks on the back of them much as the anteater walks on its folded claws.

Peculiar to North America, pocket gophers occupy a great area extending from Illinois, Florida, and the Gulf of Mexico to the Pacific coast, and from the plains of the Saskatchewan, in Canada, southward to Panama.

In the United States these animals are best known as "gophers," but in the range they occupy in the Southeastern States they are called "salamanders" and in Mexico are widely known as *tuzas*. As a rule, they frequent treeless areas, but are found also in many types of forests, from among the palms and other trees of the tropical lowlands to the oaks, pines, and firs on the mountain sides.

All members of the family live wholly underground, in many-branched horizontal tunnels, which they are continually extending in winding and erratic courses about their haunts. The tunnels are from two to about five inches in diameter, according to the size of the animal, and while usually less than six inches below the surface, the approaches to the nest and storage chambers sometimes drop abruptly two or three feet below the regular working tunnels to the level of the living quarters. At intervals along the tunnels, short side branches are used as sanitary conveniences, thus enabling the occupant to keep the main passageways in a habitable condition.

The courses of the underground workings are roughly indicated on the surface by series of piles of loose earth brought up through short side passages as the tunnels are extended. These little miners' dumps of earth vary with the size of the animal, sometimes containing more than two bushels. The outlets of the passages leading to the surface are kept plugged with loose earth. When these animals are numerous the ground is thickly dotted in all directions with earth piles, and the caving caused by the network of tunnels just below the surface renders walking difficult. The perpetual industry of these rodent miners outclasses that of the proverbial beaver.

Gophers are both diurnal and nocturnal, the gloom of their tunnels scarcely varying except when one of the outlets is temporarily opened. They are averse to light, and if the plug to a freshly made opening is removed, the observer may soon catch a glimpse of the owner as he suddenly thrusts his head into view for a moment before again plugging the door with earth.

Gophers dig their tunnels by using their teeth and the strong claws on the front feet. The loose earth is pushed along the tunnel by the head, the palms of the front feet, and the breast in little jerky movements until it is ejected on the surface dump.

Because of their poor sight, heavy bodies, and short legs, gophers are clumsy and deliberate in their movements and peculiarly helpless in the open. Apparently appreciating this, they rarely venture from their underground shelter by day except when in grainfields or similar sheltering vegetation. Here they sometimes run out two or three feet to cut down a succulent stalk and drag it hastily within the entrance of the tunnel, where it is cut into short sections and placed in the cheek pouches if to be used as food, or left on the dump if the object of the cutting is finally to secure the seeds or head of ripening grain.

During the mating season in spring, pocket gophers run about clumsily from one burrow to another and may often be seen on the surface by the light of the rising sun. Most of their short trips above ground are made at night, when they sometimes swarm out and wander over a limited territory. Their night wanderings are proved in California by the many bodies which the morning light often reveals in the sticky crude oil on newly oiled roads which the gophers have tried to cross.

From one to seven young are born in a litter, but whether there is more than one litter in a season or not is unknown. The young when about half grown migrate to unoccupied ground sometimes one or two hundred yards from the home location and make tunnels of their own.

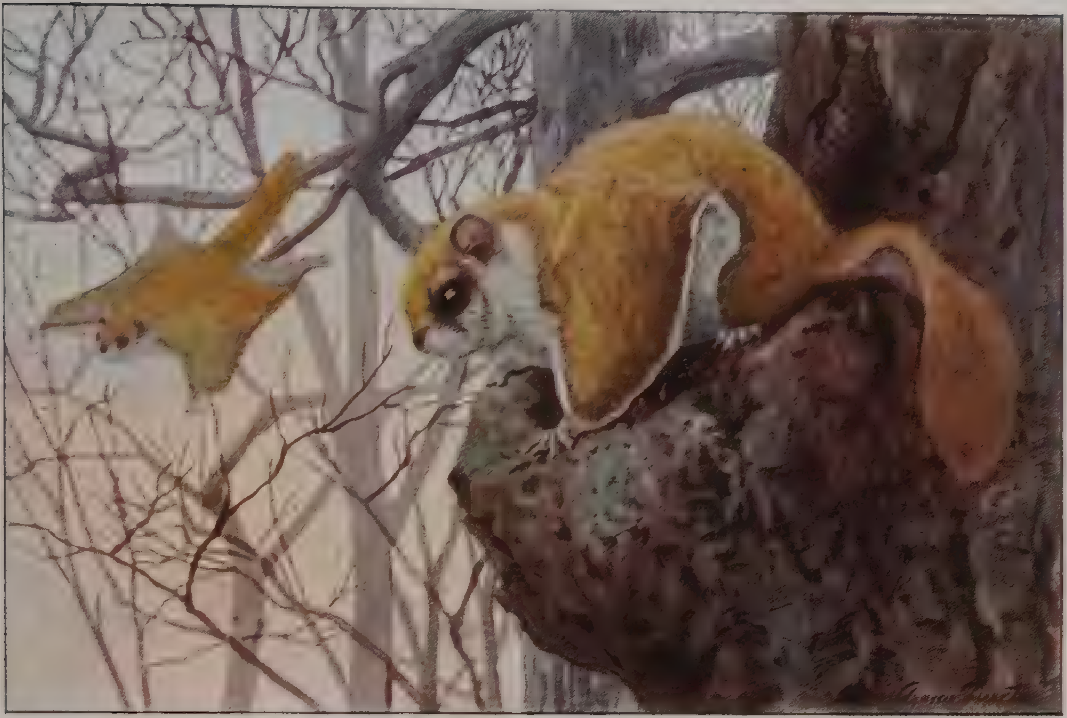
The food of pocket gophers consists mainly of tubers, bulbs, and other roots, including many of a woody fiber. Whole rows of potatoes or other root crops are cleaned up by the extension of tunnels along them. Sometimes the animals follow a row of fruit trees, cutting the roots and killing tree after tree. In grain and alfalfa fields they are great pests, and in irrigated country their burrows in ditch banks often cause disastrous breaks.

The big tropical species sometimes exist in such numbers as to render successful agriculture very difficult. Sugar-cane planters in many parts of Mexico and Central America are compelled to wage unremitting war on them to avoid ruin. I know of an instance on a plantation in Vera Cruz in which thousands were killed during a single season without stopping the damage from these pests, which swarmed in from the adjacent area.

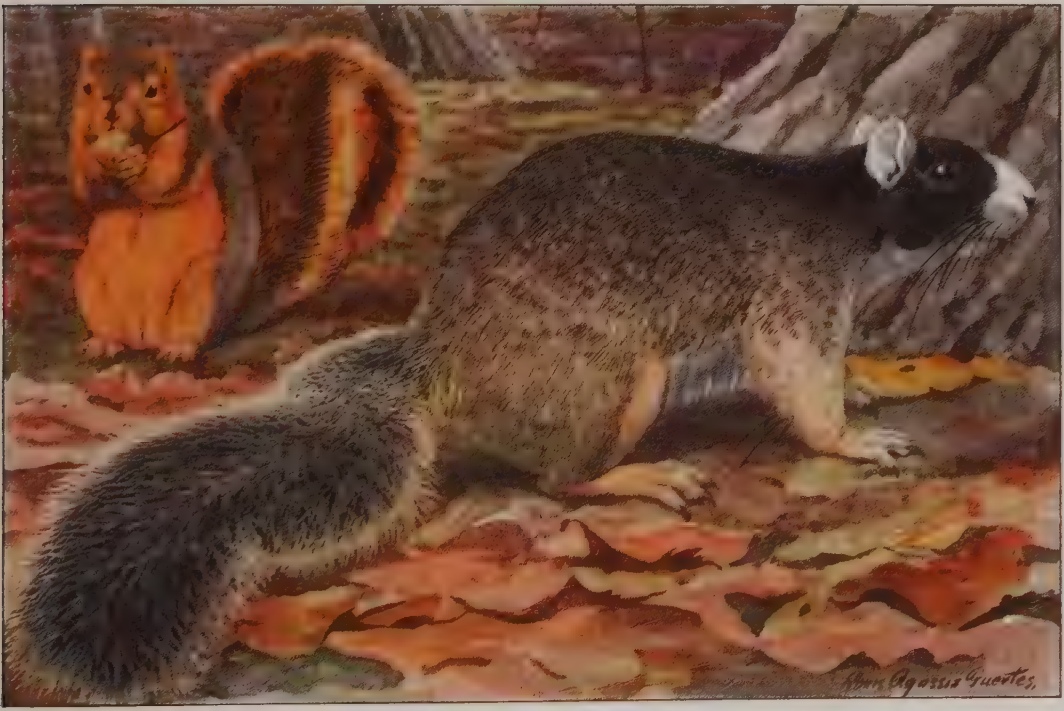
The large external cheek pouches of pocket gophers are used solely for gathering such food supplies as seeds, small bulbs, and sections of edible roots or plant stems and transporting them to storage chambers located along the sides of the tunnels. Food is placed in the pouches by deft sidewise movements of the front feet used like hands, and so quick are they that the motions of the feet can scarcely be detected. The pockets are emptied by placing the front feet on the back ends of the pouches and pushing forward, thus forcing out the contents. In their tunnels gophers run backward and forward with almost equal facility, the sensitive naked tail serving to guide their backward movements.

Pocket gophers are stupid, solitary little beasts, with surly dispositions, and fight viciously when captured or brought to bay. This attitude toward the world is justified by the host of enemies ever ready to destroy them. Among their more active foes are snakes and weasels, which pursue them into their tunnels; and badgers, which dig them out of their runways.

They are also persistently hunted day and night by foxes and coyotes. Moreover, by day

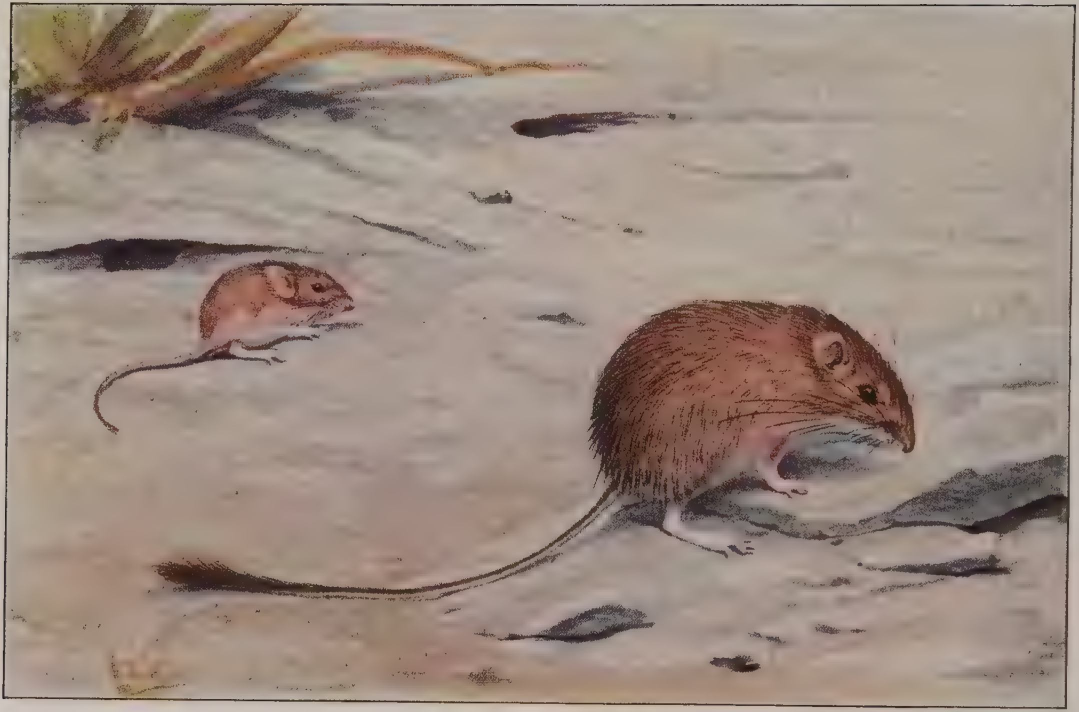


EASTERN FLYING SQUIRREL
Glaucomys volans



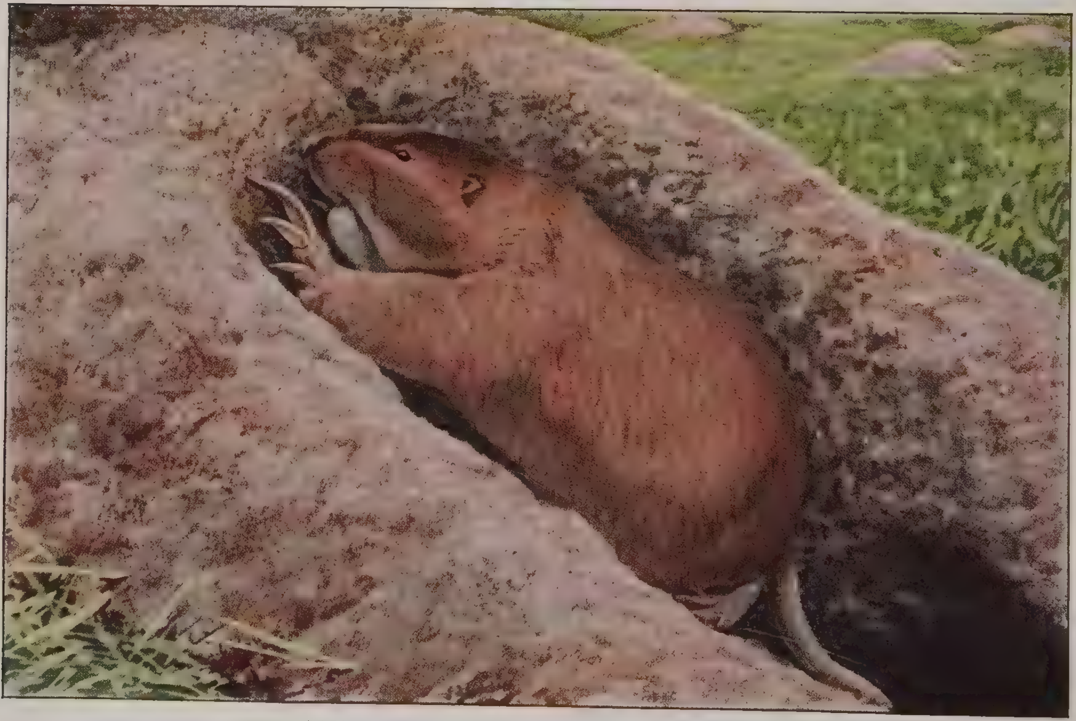
RUSTY FOX SQUIRREL
Sciurus niger rufiventer

FOX SQUIRREL
Sciurus niger



SILKY POCKET MOUSE
Perognathus flavus

SPINY POCKET MOUSE
Perognathus hispidus



MISSISSIPPI VALLEY POCKET GOPHER
Geomys bursarius

various kinds of hawks watch for them to appear at the entrances of their dens, and by night the owls, ever alert, capture many.

When one gopher intrudes into the tunnel of another, the owner at once fiercely attacks it. In some places I have seen Mexicans take advantage of this characteristic pugnacity by fastening the end of a long string about the body of a captured gopher and then turning it into an occupied tunnel, through a recently made opening. The owner, scenting the intruder, would immediately attack him, the combatants locking their great incisors in a bulldog grip. The movements of the string would give notice of the encounter, and by pulling it out steadily both animals could be drawn forth and the enraged owner of the burrow dispatched. In this manner I have known an Indian to catch more than a dozen gophers in a few hours.

Pocket gophers are active throughout the winter even in the coldest parts of their range, but in many places they must rely largely on food accumulated in their storage chambers.

Melting snow in the mountains and in the North reveals the remains of many tunnels made through it along the surface of the ground. These snow tunnels are often filled for long distances with loose earth brought up from underground, and after the snow disappears in spring the curious, branching earth forms left, winding snakelike through the meadows, are a great puzzle to those who do not know their origin.

In a state of nature pocket gophers are constantly bringing the subsoil to the surface and burying humus. Over an enormous area they exist in such countless thousands that their work, like that of angleworms, is often of the most beneficial character. On bare slopes, however, their work is highly injurious, as it greatly increases erosion of the fertile surface soil and thus has its direct influence in changing world contours.

When civilized man arrives in their haunts and upsets natural conditions with cultivated crops, the new food supply stimulates an increase in the gopher population and their activities immediately become excessively destructive and necessitate unremitting warfare against them. A few years ago the State agricultural authorities of Kansas estimated their annual damage to the alfalfa crop there at about $5,000,000.

SILKY POCKET MOUSE: **Perognathus flavus** and its subspecies

(For illustration, see Color Plate, page 146)

Soft, shining fur, delicate coloring, and graceful form distinguish the silky pocket mice from others of their kind. All are provided with little pouches on each side of the mouth for gathering and carrying food, have proportionately long tails, and hind legs and feet more or less developed for jumping. Only in the most remote way, however, are they related to the jumping mice of the jerboa family.

The silky pocket mice vary in size from the tiny yellow species, pictured on the accompanying plate, which weighs much less than an ounce, to forms considerably larger than the common house mouse. The little yellow pocket mouse is one of the smallest mammals in the world, and in addition is one of the most beautiful of our small species. Its bright eyes and the delicacy of its form and color, combined with the readiness with which, in most instances, it appears to lose all fear when caught and gently handled, render it extremely attractive.

As with the majority of other pocket mice, the silky-haired species are limited to the more arid parts of North America. They range from the Great Plains west of the Mississippi Valley to the eastern base of the Cascades, to the Sierra Nevada, and farther southward to the Pacific coast, and from the Canadian border to the Valley of Mexico. Vertically, the range of these mice extends from sea level to an altitude of more than 7,000 feet.

As with the majority of our wild mammals, little accurate information is available concerning their life history. They are inhabitants mainly of desert regions, where they prefer the areas of sandy loam which produce an abundance of scattered desert vegetation. They are nocturnal and by day are seen only when driven from their nests. Their rather shallow burrows are made in soft soil, the situation varying a little with the species. Some species burrow only under the shelter of bushes or other vegetation; others out in the bare ground.

Each burrow commonly has grouped in a small area several entrance holes, which lead through tunnels to the central passageway, the nest, and the storage chambers. Usually there is a little pile of loose dirt thrown out on one side of a hole, or a group of holes may be in a little mound of earth. The entrances are usually stopped from within by loose earth, and if a person quietly thrusts in a short stick so as to remove the earthy plug and let in the light, he may see the dirt suddenly returned to its place in little jets, as the occupant promptly kicks the door closed again.

The young, varying from two to six in a litter, are born in these little dens in warm nests of dried grasses. They have been found at all times between April and September, thus making it apparent that several litters are produced each season.

The silky, as well as the other kinds of desert pocket mice, do not drink water and, as has been shown by experiments, they may be kept for months in thoroughly dry sand and fed on dried seeds without any resulting discomfort. Through the long pressure of desert environment, they have developed the power to produce sufficient water for their physiological processes by chemical changes in the starch in their food, which are effected in the digestive tract.

Representatives of this group of mice are almost everywhere in the arid parts of their range, and in many sandy localities are extremely numerous and active at night, as shown by the multitude of little tracks in the dust at sunrise each morning. Their activities in the desert are indicated also by the many little conical pits half an inch or an inch deep, where they have located small seeds and dug them up.

They lie close in their burrows during cold or stormy weather, depending on their stores for food, but are not known to hibernate, although in the northern part of their range they are confined to their burrows for long periods.

At one of my camps in the desert of Lower California, I found the silky and other pocket mice excessively numerous and so short of food that they swarmed about us at night with amazing lack of fear. My experiences with them are given in the accompanying account of the spiny pocket mice.

The silky and other pocket mice have many enemies, among the worst of which are the handsome little desert fox and the coyote. Others which continually prey upon them are the badger, skunk, and bobcat, as well as many owls.

SPINY POCKET MOUSE: **Perognathus hispidus** and its relatives

(*For illustration, see Color Plate, page* 146)

Pocket mice of this genus are divided into several natural groups of species, but all have certain characters in common, as a pointed head, lengthened hind feet and legs, and external cheek pouches for carrying food. The spiny group contains numerous species, the smallest of which is about the size of a house mouse and the largest nearly twice that size.

They are proportionately longer than the silky species and have longer tails, with the hairs lengthened along the terminal half, thus giving a slightly brushy or tufted appearance. Their most striking character is the distinctly coarser hair with long, scattered guard hairs, like small bristles, which in some kinds conspicuously overlie the fur on the hinder parts of the body and from which the common name is derived.

The distribution of the spiny forms, although nearly the same as that of the silky ones, is a little more restricted. All belong to the arid or desert parts of the West and Southwest, from South Dakota and middle California southward to Michoacán, near the southern end of the Mexican table-land, and throughout Lower California.

Some species inhabit the scattered growth of plants in sandy areas, but they are more generally characteristic of harder and more rock-strewn soil, rocky mesas, and foothill slopes. There a few species make burrows in open ground, sometimes with a single hole, but most of them make their nests under rocks, in crevices, or in burrows sheltered by such desert bushes as Covillea, Bursera, Olneya, Cercidium, and mesquites.

In these shelters spiny pocket mice make little mounds a few inches high and 10 or 15 inches across. The mounds have several entrances on different sides, one of which generally shows signs of recent use, although by day it is kept closed from within by loose earth. Each of the many-entranced dens is occupied by a single animal. Early in the morning, before the wind fills them with dust, tiny trails are to be seen leading from these doorways toward the nearest feeding grounds and all about their haunts.

The spiny and the silky pocket mice, sharing much the same arid region, have the same food plants and are preyed upon by the same enemies. The food of these mice consists mainly of small seeds, including the wild morning-glory, wild sunflowers, wild parsnips, and a multitude of others characteristic of the various areas they occupy.

Pocket mice are strictly nocturnal or crepuscular in habits and appear by day only when disturbed. If the plugged entrance to a burrow is opened, however, it will probably be quickly stopped up again from within by the annoyed householder.

The young, in litters of from two to eight, are born at irregular times, according to the latitude and general weather conditions. In the South at least several litters appear to be born each year, the young being noted almost every month.

When camping alone for a few days in the desert near San Ignacio, in the middle of the peninsula of Lower California, I had a unique opportunity to learn something of the peculiarities of the various pocket mice. Three species were abundantly represented, including both the silky and the spiny kinds. They quickly learned that good hunting could be found in and about the tents for the rice grains and other scattered food and promptly took advantage of it.

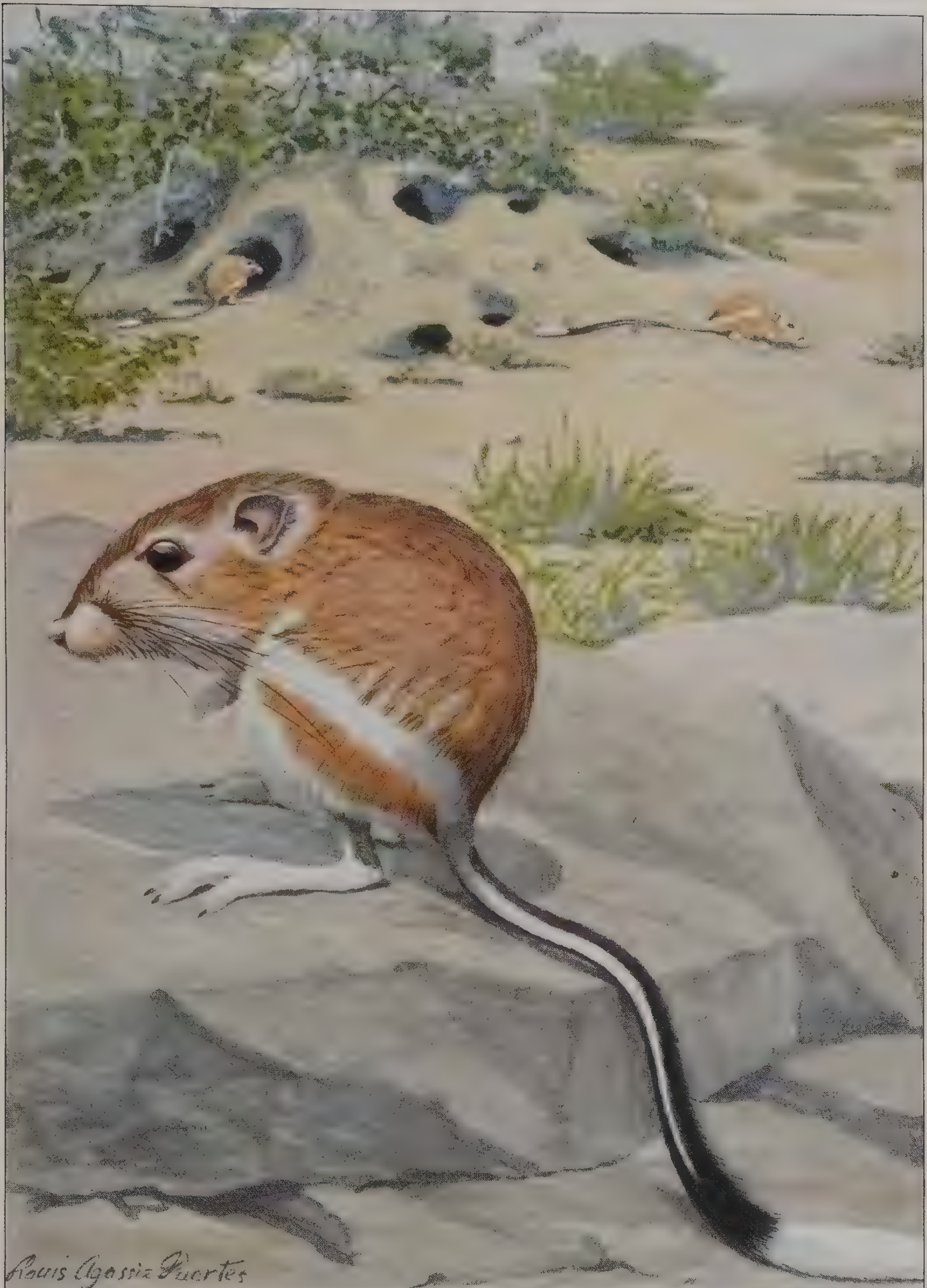
As soon as approaching darkness began to render objects indistinct, from their burrows among the surrounding bushes they swarmed into camp and were busy throughout the night, minutely searching the ground under the shelter tent for every particle of food. In order to see these interesting visitors to better advantage, I placed a candle on a small box in the middle of the tent.

Five or six individuals, representing three species, often came within the circle of light at the same time. At first all were shy and when I made any sudden movement, they would leap in every direction, like grasshoppers, and quickly vanish. The smallest of the species, a member of the silky group, was the shyest of all and remained timid and reserved.

The two larger species, representing both the spiny and the silky groups, were much more bold and quickly became confiding and delightfully friendly. Their attention was promptly attracted to rolled oats which I scattered on the ground in a spot well lighted by the candle.

Sitting quietly close by the bait where the visitors congregated, I soon had evidence that among themselves these little beasts are extremely pugnacious. The first to reach the food would fiercely charge the next comer and always try to leap upon its back, at the same time delivering a vicious downward kick with its strong hind feet. Occasionally the newcomer would charge the one already at the food.

When five or six were trying to secure sole possession of the small food pile, there was lively skirmishing about the premises, as they alternately attacked and pursued one another over the sand and among the boxes and other camp gear scattered about. Amazingly quick in movements, they would leap now forward,


Louis Agassiz Fuertes

KANGAROO RAT
Dipodomys spectabilis

now sidewise, now straight up a foot or more in the air, with almost equal celerity; and the direction of their movements when attacked was often unexpected. When running about on the level sand, they had a steady, swift, gliding motion, which their tracks showed was the result of a series of little jumps.

Both the spiny and the silky pocket mice became so confiding the first night that when I put my hand on the ground, palm up, with a little rolled oats in it, the nearest pocket mouse would run to it, stop for an instant to smell the finger-tips, and then mount and sit quietly on the palm and fill its cheek pouches.

At such times the mice showed no uneasiness, even when raised in my hand to within a few inches of my eyes in order that I might observe their movements more closely. The motions of their front feet when putting food into the pouches were so rapid that it was impossible to follow them. The nose was held just over the food pile, and the cheek pouches would slowly swell as they were filled until they stood out like little bladders on each side of the head.

As soon as they were full, the mice became anxious to get away and would run from one side of my hand to the other, peering down the abysmal depth of three feet to the ground without daring to leap. As soon as my hand was lowered to the ground, the mouse darted away to carry the food to its store in the bushes 20 to 30 yards away, quickly to return.

The mice soon became so tame that while they were on my hand or on the ground, I could with one finger of the other hand stroke gently the tops of their heads and backs and even pick them up by their tails and suspend them head down. When thus held, they remained motionless, their tiny front feet like little closed hands held against their breasts. When lowered and released, they would immediately resume the filling of their pouches as if nothing had happened. Several of the dozen or more which made free of the tent had lost parts of their tails, so that they could be readily distinguished.

One of these little bobtails was so gentle and confiding that I became much attached to it. It would permit all manner of familiar treatment, such as being picked up by one foot or by the tail, or being turned on its back. With this confidence came a sense of proprietorship in the good things here so suddenly and mysteriously plentiful.

Again and again when he was filling his pouches from a pile of rolled oats in my hand, I lowered it in a gently sloping position within 10 or 15 inches of another mouse gathering food on the ground. Thereupon, the little bobtail in my hand would invariably leave the task of filling his pouches and without hesitation leap down on the back of the one on the ground. The surprised animal thus assailed from an unexpected quarter always fled in terror.

After a short pursuit the bobtailed one would come running back, and, instead of going to the equally inviting pile of food on the ground, would come straight to my hand and complete his task. The industry of the little animals appeared to be tireless, as working swiftly they made trip after trip with pouchloads of food to their stores and quickly returned. One night I watched this strenuous work for two hours.

The abundance and boldness of pocket mice and kangaroo rats at this place led me to believe that there had been a former abundance of their food here, resulting in a large increase in the rodent population, but that it was then becoming scarce through a failure of rain to renew the seed harvest. The invariable outcome in such cases is for the small rodents dependent on seeds and fruits to be reduced by famine until they become rare, where previously they existed in great numbers. This is one of Nature's processes whereby the danger of the overwhelming increase of any species is automatically prevented.

KANGAROO RAT: Dipodomys spectabilis and its relatives

(*For illustration, see Color Plate, page* 149)

The desert regions of western North America have developed several peculiar types of mammals, and among them are none handsomer or more interesting than the kangaroo rats. These rodents, despite their name, are neither kangaroos nor rats, but are near relatives of the pocket mice which share their desert haunts.

All are characterized by a kangaroolike form, including small forelegs and feet, long hind legs and feet for jumping, and a tail longer than the body to serve as a balance. They have large, prominent eyes and are provided with skin pouches on each side of the mouth for holding food to be carried to their store chambers.

The color pattern, like the form, of the kangaroo rats is practically uniform throughout the group. Both are well shown in the accompanying plate of *Dipodomys spectabilis,* the largest and most strongly marked species. Its total length is from 12 to 15 inches; most of the other species are much smaller.

Kangaroo rats of many species are distributed over most of the arid and semiarid regions of the United States and Mexico. They are especially numerous in the southwestern deserts.

Although they have no near relatives in the Old World, some of the African and Asiatic jerboas are externally almost perfect replicas of the kangaroo rats in every detail of form, color, and color pattern, even to the tail markings. This extraordinary likeness in appearance of two widely separated and unrelated animals is made doubly significant by the fact that both live in deserts and have similar habits.

Peculiarly desert animals, kangaroo rats live like the pocket mice, without drinking, but obtain the necessary water through their digestive processes. They are most numerous in sandy areas, and there the earth is sometimes so riddled by their burrows as to render horseback riding difficult.

Kangaroo rats are nocturnal and always live in burrows dug by themselves. As a rule, they prefer soft or sandy ground, but some species occupy areas where the earth is hard and rocky. The burrows of some species have only one or two entrances with a small amount of earth thrown out, but others make little mounds with several openings, entering usually nearly on a level or at a slight incline. These openings are nearly always conspicuous, and while frequently near bushes, no effort appears ever to be made to conceal them, and a little trail often leads away through the soft earth.

The large *Dipodomys spectabilis,* which lives mainly in New Mexico and Arizona, constructs the most notable of all the dwelling places of these animals. From its underground workings it throws up large mounds of earth, which gradually increase in size with the length of time they are occupied until they are sometimes more than 3 feet high and 15 feet or more in diameter. From three to a dozen burrows enter these mounds, usually at the surface level of the ground, but some are on the slopes of the mound. The mounds, usually located in open ground, with their round entrance holes from four to five inches in diameter, are extremely conspicuous.

Although generally scattered at varying distances from one another, the mounds are sometimes grouped in colonies. Well-worn trails three or four inches broad lead away from the entrances, some to other mounds showing neighborly intercourse and others far away to the feeding grounds, sometimes 200 or 300 yards distant. One of the openings at the side of the mound is usually the main entrance, and by day this is ordinarily kept stopped with fresh earth. Within the mound and farther underground are dug a series of ramifying passages, among which are located nest and food-storage chambers.

Kangaroo rats are not known to hibernate in any part of their range. They lay up food for temporary purposes at least and do not go abroad in stormy or cold weather. The Northern species and those on the colder mountain slopes must make large store against the winter needs. Their food consists mainly of seeds, leaves of several plants, and of little plants just appearing above ground. Tiny cactus plants and the saline fleshy leaves of *Sarcobatus* are often among the kinds gathered for food.

The big *Dipodomys spectabilis* appears to be more social than most of its kind, as several may be caught in a single mound, and, as already said, well-worn trails lead from mound to mound. A little noise made just outside one of these mounds usually brings a reply or challenge in the form of a low drumming or thudding noise, no doubt made by the animal rapidly striking the ground with its hind feet like a rabbit or wood rat.

When caught they at first struggle to escape, but, like a rabbit, do not offer to bite, and soon become quiet. They have from two to six young, which may be born at any season. Nothing appears to be known concerning the number of litters in a year.

When in camp at San Ignacio, in the middle of the desert peninsula of Lower California, I had an unusual opportunity to learn something of the habits of one of the smaller species of kangaroo rat abundant there. The moon was at its full, and in the clear desert air its radiance rendered objects near at hand almost as distinct as by day. Scattered grains of rice and fragments of food on the ground about the cook tent attracted many kangaroo rats and pocket mice.

During several nights I passed hours watching at close range the habits of these curious animals. As I sat quietly on a mess box in their midst, both the kangaroo rats and the mice would forage all about with swift gliding movements, repeatedly running across my bare feet. Any sudden movement startled them and all would dart away, but quickly return.

Although the kangaroo rats did not become so fearless and friendly as the pocket mice, they were so intent on the food that at times I had no difficulty in reaching slowly down and closing my hand over their backs. I did this dozens of times, and after a slight struggle they always became quiet until again placed on the ground, when they at once renewed their search for food as though no interruption had occurred.

One night, to observe them better, I spilled a small heap of rice on the sand between my feet. Within two or three minutes half a dozen kangaroo rats had discovered it, and were busily at work filling their cheek pouches with the grains and carrying them away to their store chambers.

While occupied in this rivalry for food they became surprisingly pugnacious. If one was working at the rice pile and another rat or a pocket mouse approached, it immediately darted at the intruder and drove it away. The mode of attack was to rush at the newcomer and, leaping upon its back, give a vigorous downward kick with its strong hind feet. Once I saw a pocket mouse kicked in this way. It was knocked over and for a minute or more afterward ran about in an erratic course, squeaking loudly as though in much pain.

Sometimes the pursuit of one kangaroo rat by another continued for 20 yards or more. By the time the pursuer returned, another would be at the rice pile and it would immediately dash at the victor of the former fray and drive him away. In this way there was a constant succession of amusing skirmishes.

Sometimes an intruder, bolder than the others, would run only two or three yards and then suddenly turn and face the pursuer, sitting up on its hind feet like a little kangaroo. The pursuer at once assumed the same nearly upright position, with its forefeet close to its breast. Both would then begin to hop about watching for an opening. Suddenly one would leap at the other, striking with its hind feet exactly like a gamecock. When the kick landed fairly on the opponent, there was a distinct little thump and the victim rolled over on the ground. After receiving two or three kicks, the weaker of the combatants would run away.

The thump made by the kick when they were fighting solved the mystery which had covered this sound heard repeatedly during my nights at this camp. The morning light revealed a multitude of little paired tracks made by the combatants in these battles. Such tracks in the sand have been referred to as the "fairy dances" of these beautiful little animals, but the truth revealed proves them to be really "war dances."

Chapter IX

Beavers, Grasshopper Mice, Harvest Mice, White-footed Mice, Wood Rats, Lemmings, and Tree Mice

THE species of this chapter, like those of Chapters VII and VIII, are members of the great Order of *Rodentia*.

The only living members of the Family *Castoridæ* are the well-known beavers of North America and northern Europe. They are, next to the capybara of South America, the largest living rodents, old males sometimes attaining a weight of more than 70 pounds. Their size and the broad, horizontally flattened, hairless tail at once distinguish them from all our other rodents.

Although the beavers, Genus *Castor*, of North America and of Europe are generally considered as distinct species, they are so closely similar that some have believed they were merely subspecies. In Europe the beaver has been exterminated over much of its former range, the last record in England being in the 12th century. From all accounts, the habits of North American beavers are much more developed and interesting than those of their relatives in the Old World.

The Family *Cricetidæ*, consisting of native rats and mice, is by far the largest family of North American mammals. It contains nearly 20 genera of small beasts varying from the size of a small mouse to the muskrat. Among these are more than 300 species and subspecies of an extraordinary variety of structure, habits, and appearance. The members of this great group have developed a wonderful variety of habits to fit into every kind of environment, from sandy or marshy seashore to the limit of vegetation on high mountain tops, and from the most arid desert plains to the densest rain forests of the Tropics.

Grasshopper mice, Genus *Onychomys*, are distinguished by their comparatively short, robustly proportioned bodies, a short and rather fleshy tail, and by their largely carnivorous habits. The genus, a purely North American one, belongs to the relatively arid regions from the Great Plains to the Pacific coast and from the Saskatchewan to the Mexican table-land.

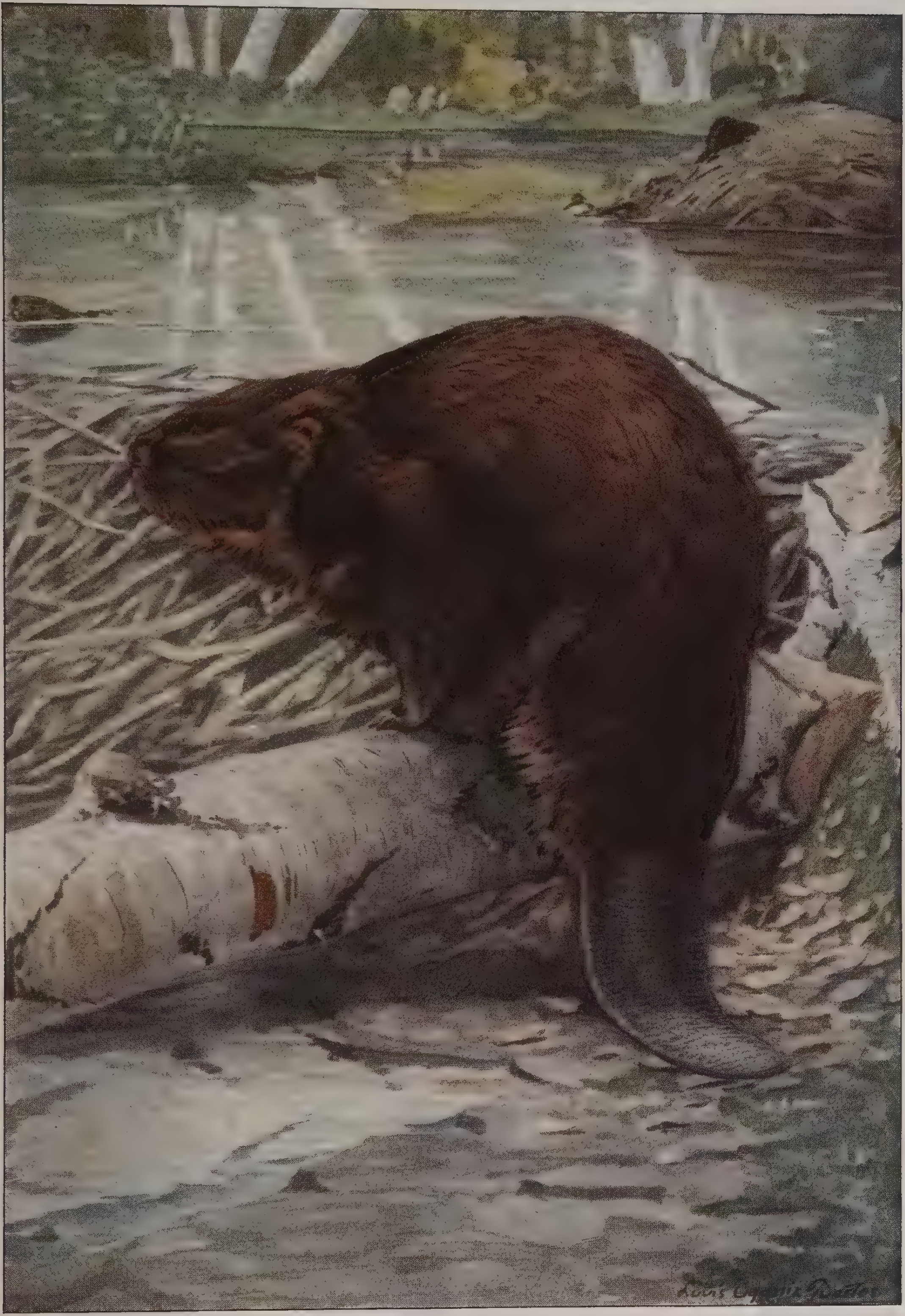
Harvest mice, Genus *Reithrodontomys*, are delicately built little animals having a slight resemblance to house mice, but with more graceful proportions. They are peculiar to North and Central America and occur from the Atlantic to the Pacific coast and from the northern United States in the west south to northern South America. Within this great area they are subdivided into about 60 species and subspecies, all having a close general resemblance.

WHITE-FOOTED MICE INCLUDE NEARLY 150 SPECIES AND SUBSPECIES

White-footed mice, Genus *Peromyscus*, are peculiar to North and South America, and include far more species, subspecies and individuals than any other American genus of mammals. They appear to be very responsive to environment, and in North America, from near the limit of trees in the north to Panama, nearly 150 species and subspecies are known. They vary from about the size of the house mouse to several times its bulk. Almost all of them have white underparts, but their upper parts vary from nearly white through many shades of buff, gray, and brown. Their large ears, bright eyes, and delicate proportions often make them very handsome little beasts.

The wood rats, forming the Genus *Neotoma*, are limited to the Continent of North America, where they range from coast to coast in the United States and north along the Rocky Mountains to Yukon Territory and south to Nicaragua. They are a prolific group, containing about 75 species and subspecies. They vary considerably in size, but average about as large as small house rats, to which many of them have a general resemblance. They are more delicately tinted, and have hairy tails; in fact, one group of them has bushy tails, almost like squirrels. Altogether, they are distinctly more attractive in appearance than the house rat.

Few small mammals are so well known in far-northern lands as the brown lemmings, Genus *Lemmus*. They form a small group having a close general resemblance to some of the field mice of the



AMERICAN BEAVER
Castor canadensis

Genus *Microtus,* from which they may be at once distinguished by their heavier proportions, very short, stubby tails, and the remarkable length of the hair on their rumps. About half a dozen forms of this genus are known in North America, probably all subspecies of a single species.

COLLARED LEMMINGS LIVE IN ARCTIC LANDS

Collared lemmings, curious little beasts of the Genus *Dicrostonyx,* are circumpolar in distribution and are limited to the arctic tundras and adjacent borders of the subarctic areas. Seven species and subspecies are known from North America, from Greenland and Labrador to some of the islands in Bering Sea. With the apparent exception of a species with one subspecies in the Aleutian Islands, all of them take on a very heavy, snowy white coat in winter and have the middle claws of the front feet enormously enlarged into thick, club-shaped form. Both these characters change in spring. During summer they have coats of varying brown shades, according to the region they occupy, and the claws are only a little larger than normal.

The Genus *Phenacomys,* consisting of rufous tree mice, is wholly American, and contains about 14 species and subspecies which have a close general resemblance to some species of meadow mice, *Microtus.* They occur in Labrador and Ungava, across the continent to the Pacific coastal region from British Columbia to northern California, down the Sierra Nevada, and down the Rocky Mountains to Colorado.

The arboreal habits of one of them are remarkable, considering its sturdy body and its close affiliations with numerous purely ground-frequenting species. The discovery of fossil representatives of the genus in Hungary and England indicates that it once had a circumpolar distribution.

With its closest relatives, the field mice, the Genus *Evotomys,* consisting of red-backed mice, shares a circumpolar distribution, mainly in Arctic and subarctic lands, but going much farther south along the mountains of North America. This continent possesses about 24 species and subspecies, readily distinguished by their reddish backs from the meadow mice which they so closely resemble in form and habits.

AMERICAN BEAVER: Castor canadensis and its subspecies

(*For illustration, see Color Plate, page* 153)

When North America was first colonized, beavers existed in great numbers from coast to coast, in almost every locality where trees and bushes bordered streams and lakes, from near the Yukon Delta, in Alaska, and the Mackenzie Delta, on the Arctic coast, south to the mouths of the Colorado and the Rio Grande on the Mexican border. Although now exterminated from most of their former range in the eastern United States, they still occur in diminished numbers over nearly all the remainder of their original territory, even in the lower Rio Grande and the delta of the Colorado. Their vertical distribution extends from sea level to above an altitude of 9,000 feet.

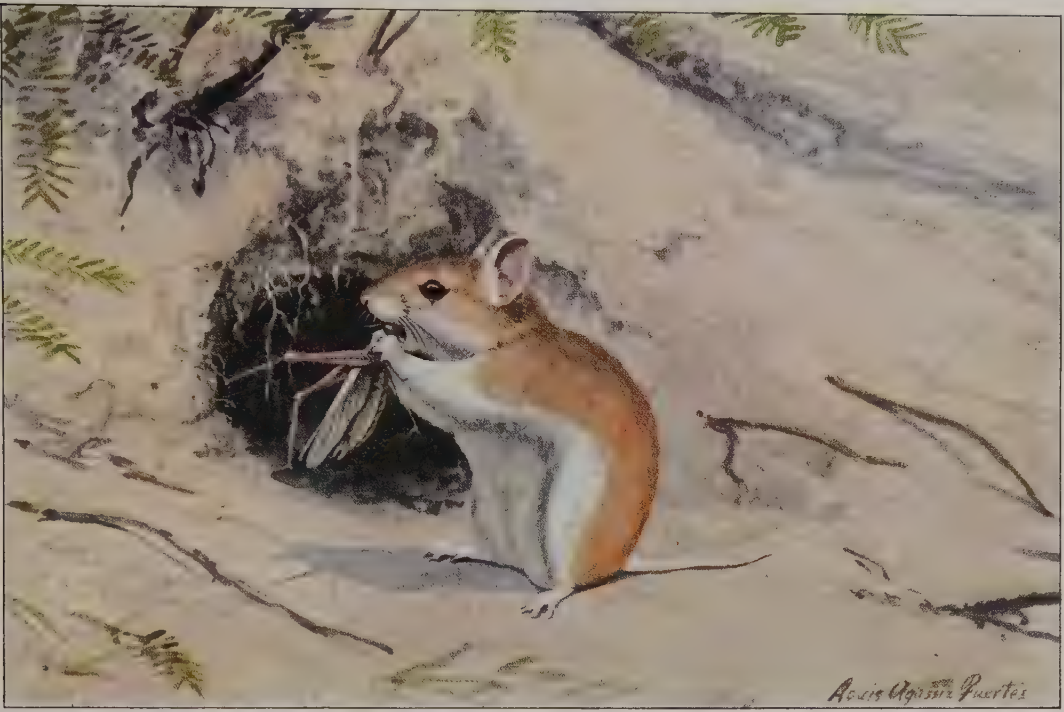
Beavers are heavily built, round-bodied animals, with powerful chisel-shaped front teeth, short legs, fully webbed hind feet, and a flat, scaly tail. They are covered with long, coarse hairs overlying the short, dense, and silky underfur to which beaver skins owe their value. Their range covers the northern forested parts of both Old and New Worlds. The American species closely resembles in general appearance its Old World relative, but is larger, averaging 30 to 40 pounds in weight. Sometimes it attains a weight of more than 70 pounds. Because of the different physical conditions in its wide range, the American animal has developed a number of geographic races.

Beavers appear to mate permanently and have from two to five young each year. Their abundance and the high value of their fur exercised an unparalleled influence on the early exploration and development of North America. Beaver skins were the one ready product of the New World which the merchants of Europe were eager to purchase. As a result, competition in the trade for these skins was the source of strong and bitter antagonisms between individuals and companies, and even caused jealous rivalries among the Dutch, English, and French colonies.

Disputes over the right to trade in certain districts often led to bloodshed, and even to long wars, over great areas, where powerful rival companies fought for the control of a new empire.

This eager competition among daring adventurers resulted in the constant extension of trading posts through the North and West, until the vanguard of civilization reached the far borders of the continent on the shores of the Arctic and Pacific Oceans.

Among the fur traders the beaver skin became the unit of value by which barter was conducted for all sorts of commodities. This usage extended even throughout northern Alaska, where it was current among the American fur traders until the gold rush there upset old standards.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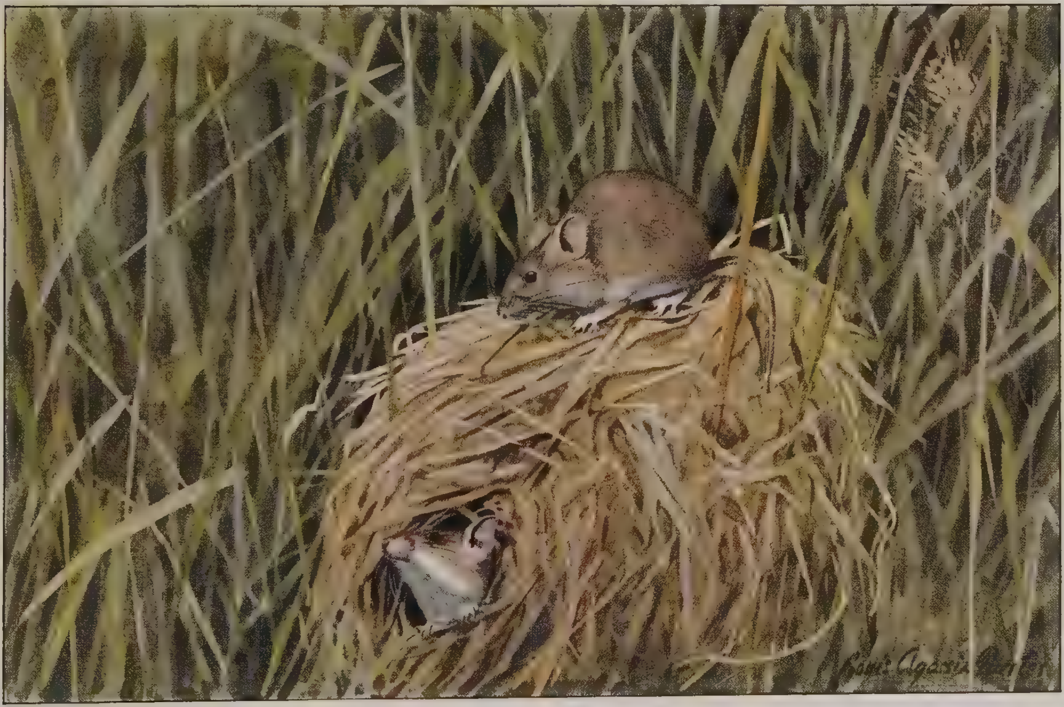
GRASSHOPPER MOUSE
Onychomys leucogaster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HARVEST MOUSE
Reithrodontomys megalotis

Though the rodent family is notable as a whole for its weak mental powers, the beaver is the striking exception to the rule, and its extraordinary intelligence, industry, and skill have long excited admiration. It is scarcely entitled to the almost superhuman intelligence with which many endow it, yet it certainly possesses surprising ability along certain lines. Furthermore, it can alter its habits promptly when a change in environment renders this advantageous.

In wild places, where rarely disturbed, beavers are unsuspicious, but where they are much trapped they become amazingly alert and can be taken only by the most skillful trapping. They are very proficient in building narrow dams of sticks, mud, and small stones across small streams for the purpose of backing up water and making "beaver ponds." In the border of these ponds a conical lodge is usually constructed of sticks and mud. It is several feet high and about 8 or 10 feet across at the base.

The entrance is usually under water, and a passageway leads to an interior chamber large enough to accommodate the pair and their well-grown young. From the ponds the animals sometimes dig narrow canals several hundred feet long back through the flats among the trees. Having short legs and heavy bodies, and consequently being awkward on land, beavers save themselves much labor by constructing these canals for transporting the sticks and branches needed for food and for repairing their houses and dams.

Along the Colorado, lower Rio Grande, and other streams with high banks and variable water level, beavers usually dig tunnels leading from an entrance well under water to a snug chamber in the bank above water level. Under the varying conditions in different areas, they make homes showing every degree of intergradation between the two types described.

Beavers live almost entirely on twigs and bark, and their gnawing powers are surprising. Where small trees less than a foot in diameter abound, they are usually chosen, but the animals do not hesitate to attack large trees. On the headwaters of the San Francisco River, in western New Mexico, I saw a cottonwood nearly 30 inches in diameter that had been felled so skillfully that it had fallen with the top in the middle of a small beaver pond, thus assuring an abundance of food for the animals at their very door. In northern Michigan, equally large black ash trees are cut down by them.

In the cold northern parts of their range, where streams and ponds remain frozen for months at a time, beavers gather freshly cut green twigs, sticks, and poles, which they weight down with mud and stones on the bottom, near their houses, to be used for food during the shut-in period.

The mud used by beavers in building dams and houses is scooped up and carried against the breast, the front feet being used like hands. The flat tail serves as a rudder when the animal is swimming or diving, and to strike the surface of the water a resounding slap as a danger signal.

Beavers are usually nocturnal, but in districts where not disturbed they sometimes come out to work by day, especially late in the afternoon. Among the myriads of small streams and lakes in the great forested area north of Quebec they are very plentiful; their dams and houses are everywhere, sometimes four or five houses about one small lake. Their well-worn trails lead through the woods near the lake shores and frequently cross portages between lakes several hundred yards apart.

Where beavers continue to occupy streams in settled districts, they often make regular trails from a slide on the river bank back to neighboring cornfields, where they feast on the succulent stalks and green ears. They also injure orchards planted near their haunts, by girdling or felling the trees. Within recent years laws for their protection have been passed in many States, and beavers have been successfully reintroduced in many localities. They should not be colonized in streams flowing through lands used for orchards or cornfields, nor where the available trees are too few to afford a continuous food supply.

GRASSHOPPER MOUSE: Onychomys leucogaster and its relatives

(For illustration, see Color Plate, page 155*)*

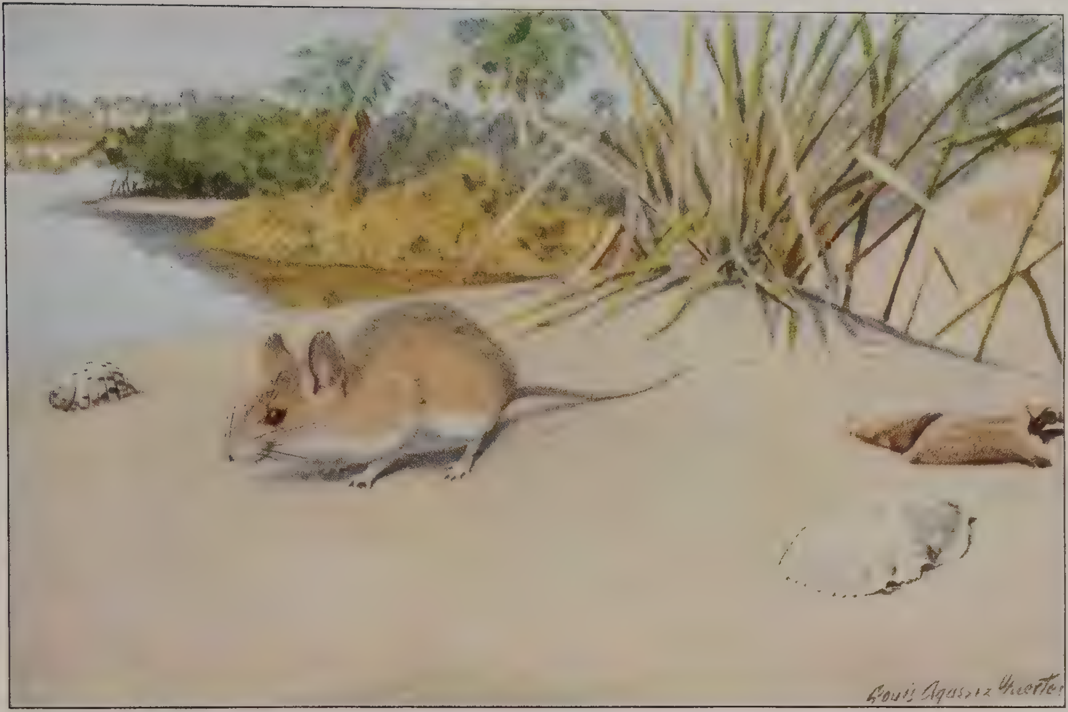
The grasshopper mice are notable for the delicate coloring and velvety quality of their fur. While closely resembling some of the white-footed mice, they may readily be distinguished from them by a more robust form, a short, thick tail, and the character of the fur.

Only two species, each with numerous geographic races, are known and both are peculiar to North America. Characteristic animals of the arid and semiarid treeless plains, plateaus, and foothills of the West, their known range extends from Minnesota and Kansas west to the Cascades and to the Pacific coast of southern California, and in the north, from the plains of the Saskatchewan southward to San Luis Potosí, on the table-land of Mexico.

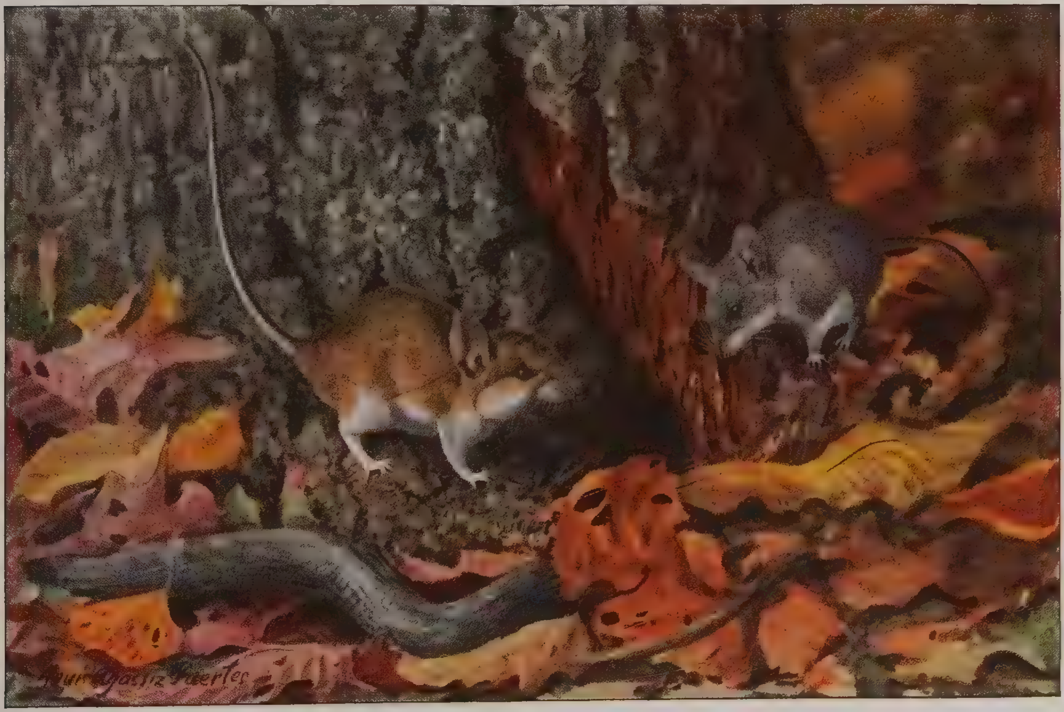
Some races live on the grassy Plains west of the Mississippi, but the majority prefer the looser soil and sandy areas of the more arid Great Basin and the even more desert Southwest, where the vegetation is characterized by a scattered growth of woody plants, including many species of cacti, yuccas, agaves, sagebrush, greasewood, mesquites, acacias, and other picturesque types.

Like other small mammals of the open Plains, the grasshopper mice live in burrows. When opportunity offers they evade the labor of digging these for themselves by occupying the deserted holes of mice, kangaroo rats, ground squirrels, prairie dogs, badgers, and other animals. In these retreats they have nests of soft vegetable matter and bring forth each season several litters containing from two to six young.

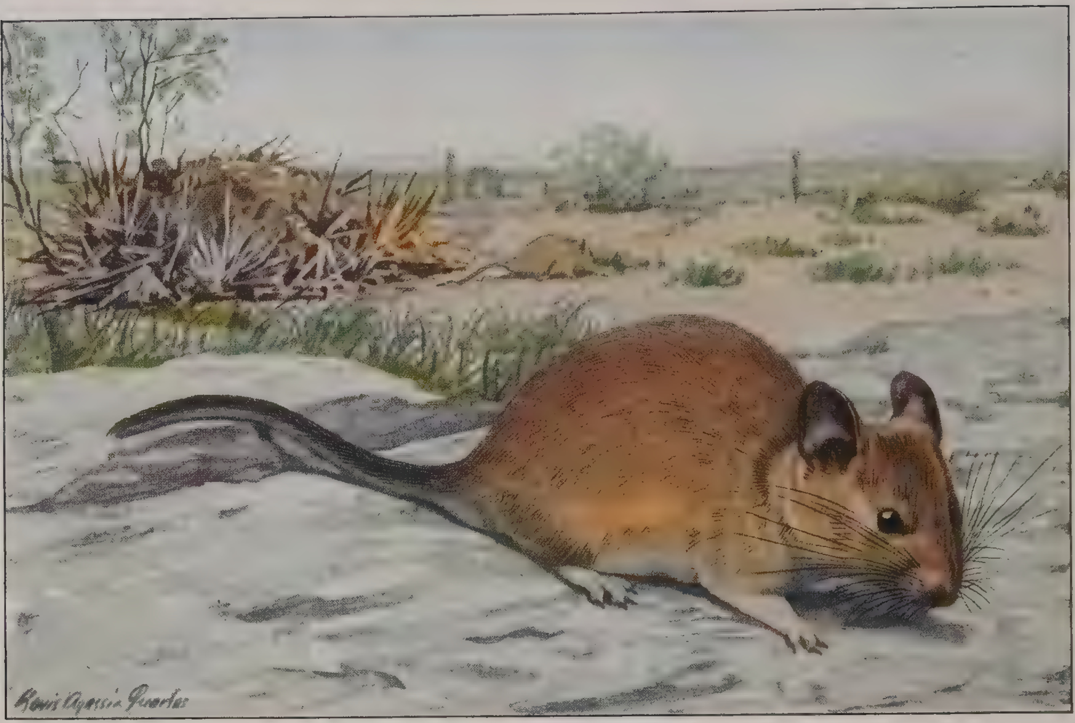
They are active throughout the year, but nothing appears to be known as to the kind and amount of stores they lay up for winter use. As many live far enough north to experience a long period of cold, with snow covering the earth, there is little doubt that they exercise the same prevision in providing stores to meet the need as do many other small mammals.



FLORIDA BEACH MOUSE
Peromyscus polionotus niveiventris



WHITE-FOOTED MOUSE (adult and young)
Peromyscus leucopus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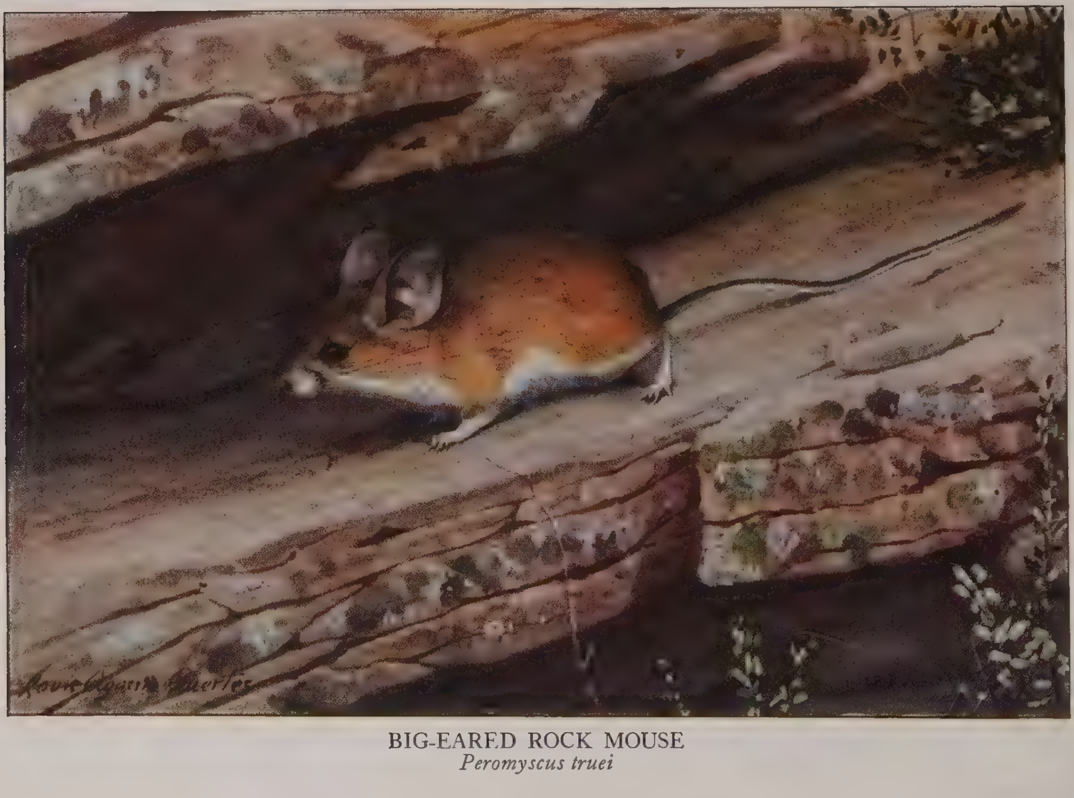
WHITE-THROATED WOOD RAT
Neotoma albigula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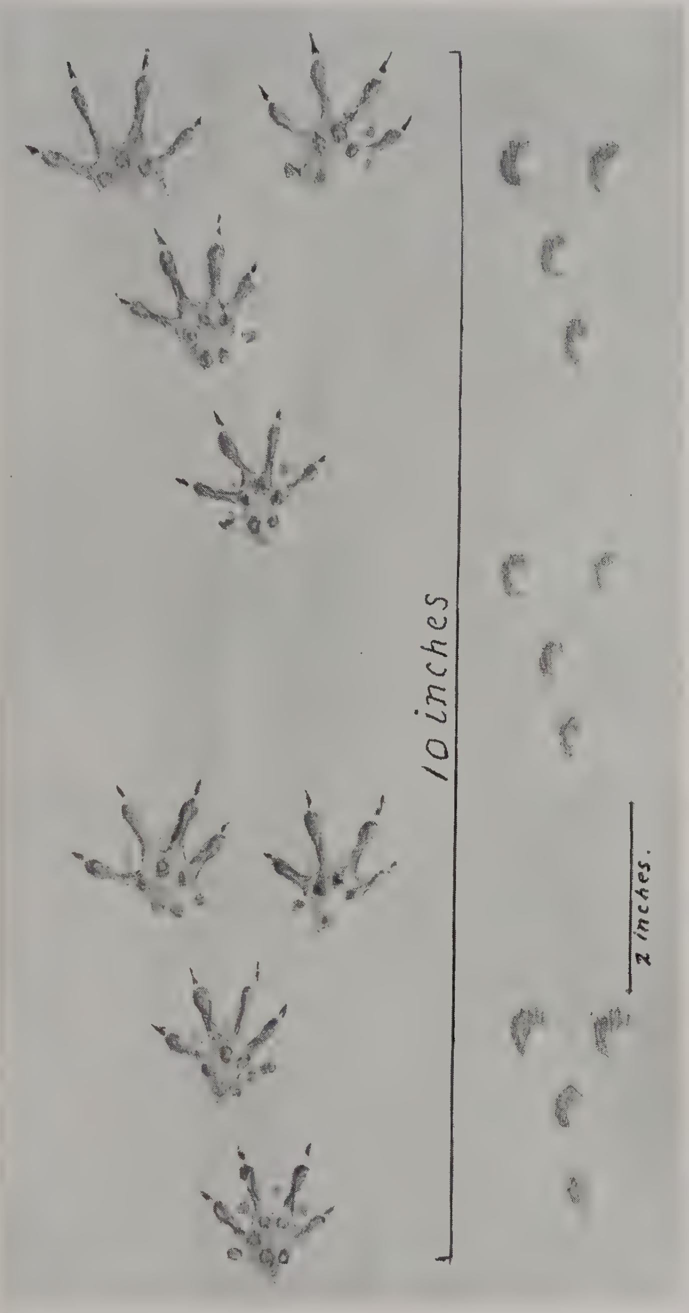
BIG-EARED ROCK MOUSE
Peromyscus truei

Many species of mice eat insects or meat and even on occasion devour one of their own kind. The grasshopper mice go far beyond this and are often not only as fierce flesh eaters as real carnivores, but make their diet, at least during the summer season, mainly of insects and other small invertebrates. Their bill of fare includes a miscellaneous assortment of several species of mice, including their own kind caught in traps, small dead birds, lizards, frogs, cutworms, scorpions, mole crickets, ordinary crickets, grasshoppers, moths, flies, and beetles, including the "potato bug."

In addition, they eat many kinds of seeds, fruit, and other vegetable matter. Where obtainable, grasshoppers are one of their favorite foods, and from this they receive their common name. In Colorado, from their fondness for scorpions, they are sometimes called "scorpion mice."

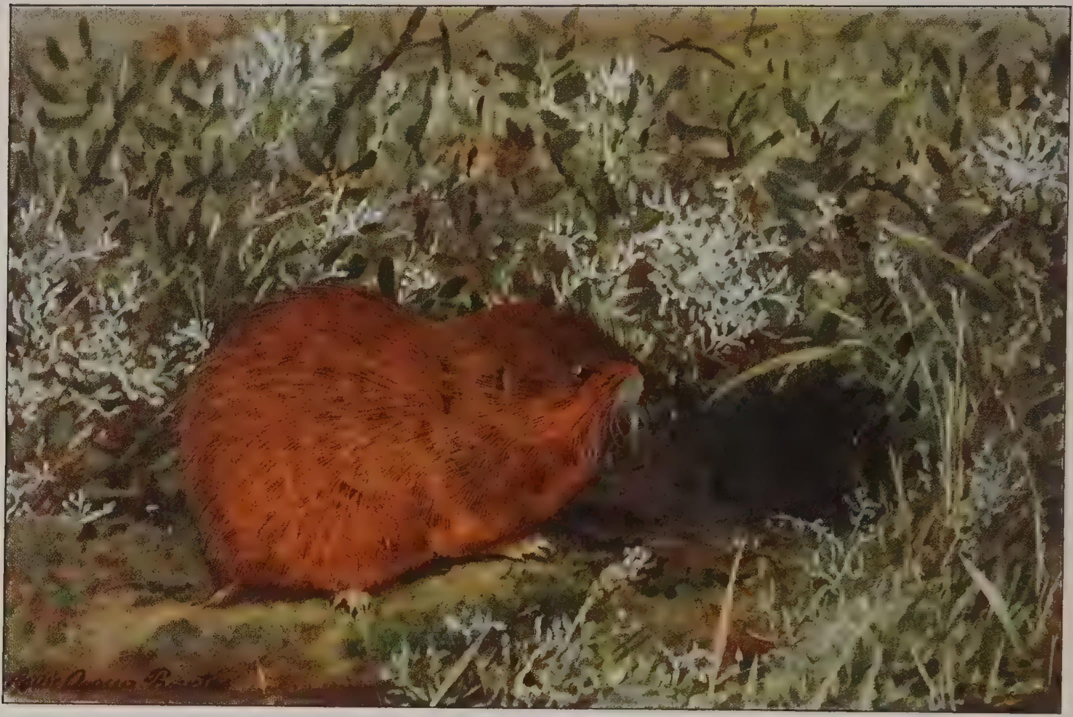
Vernon Bailey's observations of a grasshopper mouse he had in captivity are illuminating as to their habits, and indicate that their presence in numbers about cultivated land must be of distinct economic value. When undisturbed and well fed, the captive was entirely nocturnal, sleeping all day and becoming very active at night. While usually quiet, sometimes he tried furiously to escape from his small prison box by jumping with all his force. His favorite food consisted of crickets, grasshoppers ranking next. His fare also included a black beetle, ladybirds, a potato beetle, spiders, bugs, and dragon flies.

In feeding he sat upright on his haunches and held the insects in his front paws, eating them head first. Large grasshoppers, their tails resting on the ground, were held head up by a paw on each shoulder. A grasshopper

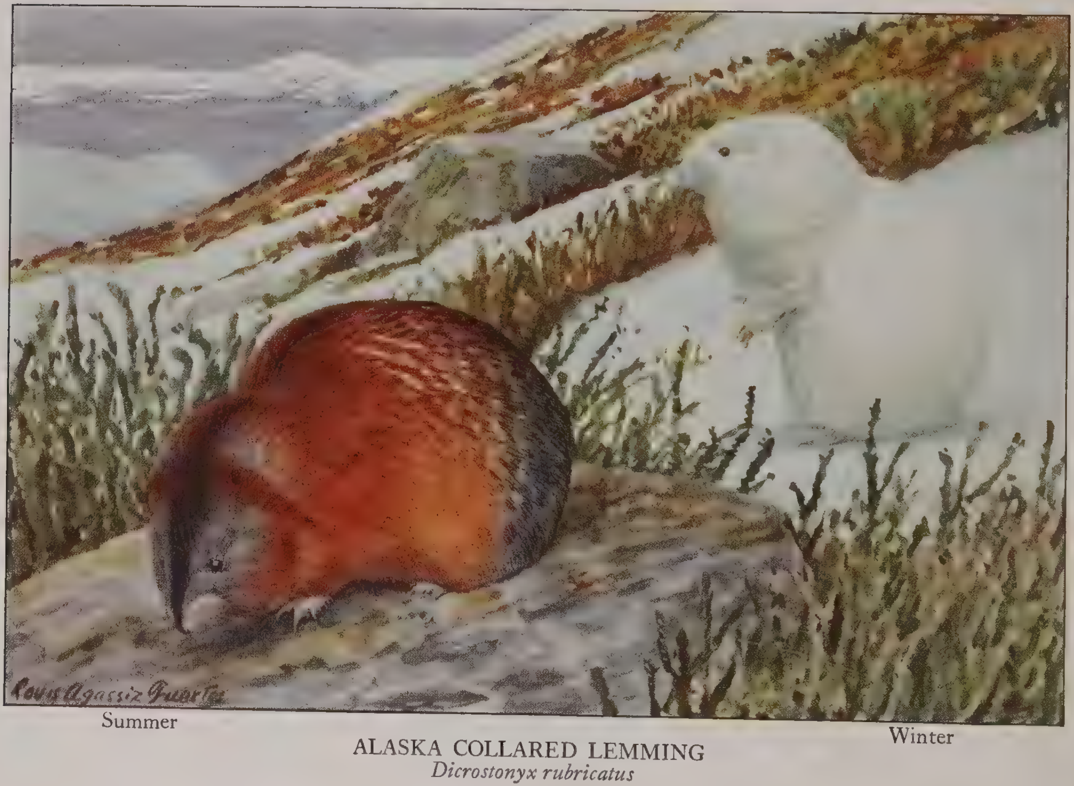


THE TRACKS OF A GRASSHOPPER MOUSE

The anatomy of the foot is fairly well shown in the track—the insignificant thumb and the tubercles on the soles. The placing of the forefeet, one behind the other, indicates that the creature cannot climb a tree. The tail seldom or never shows. The original of this was in fine dust. The small tracks to the right show the style usually seen. There are many species of grasshopper mouse, but the tracks are not distinguishable from each other.



ALASKA BROWN LEMMING
Lemmus alascensis


Louis Agassiz Fuertes

Summer

Winter

ALASKA COLLARED LEMMING
Dicrostonyx rubricatus

would sometimes kick so vigorously as to tip the mouse off its balance, but was never relinquished until decapitated.

The mouse promptly killed and ate a small frog placed in his box and was expert at catching flies. He ate many kinds of insects, including a live wasp, but appeared terror-stricken if a few ants were put in with him. When a dozen or more crickets and grasshoppers were put into his box at the same time, he at once proceeded to bite off all their heads before beginning to feast upon them.

A dead white-footed mouse was dropped in and "he pounced upon it like a cat, caught it by the side of the head near the ear, and began biting it with all the ferocity of a coon dog." The bones could be heard cracking and after the little beast appeared satisfied that his prey was really dead, he ceased worrying it. An examination showed that he had bitten through its skull deep into the brain. Afterward he tore off and ate fragments of flesh from its head, neck, and shoulders. The ferocious certainty with which he seized the white-footed mouse by the head and bit through its skull indicated that in relation to small mammals he, probably like all his kind, had the predatory instincts and habits of the carnivores.

One morning he ate 12 crickets and a spider in seven minutes and during a single day devoured 53 insects—2 beetles, 8 grasshoppers, 28 crickets, and 15 flies—and appeared ready to take more.

Oddly enough, this grasshopper mouse, so fierce toward small game, never offered to bite when captured or when handled freely, but continued throughout his captivity to have the same friendly confidence in his captor. Others caught in various parts of their range have shown the same characteristics.

At night, especially early in the evening, grasshopper mice utter a fine, shrill, whistling call note. This habit appears peculiar to them among all the mice and may be likened to that of many of the large beasts of prey in uttering their hunting call as they sally forth for the night's foray.

HARVEST MOUSE: Reithrodontomys megalotis and its relatives

(For illustration, see Color Plate, page 155)

In size, proportions, and color the harvest mice, of all our American species, most closely resembles the common house mouse. Many of them are decidedly smaller than that animal and they rarely, if ever, exceed it in size. They may be distinguished from the house mouse by their browner colors, more hairy tail, and especially by a little groove which extends down the front of each upper incisor.

The mice of this group include many species and subspecies and have a wide distribution ranging from Virginia, in the eastern United States, to the Pacific, and from North Dakota, Montana, and Washington southward through Mexico and Central America to northern South America.

They reach their greatest development in number and diversity of species in the region about the southern end of the Mexican table-land, where I have caught them from the tropical lowlands, near sea level, up to an altitude of 13,500 feet, at timber-line, on Mount Iztaccihuatl.

These delicately proportioned and graceful little beasts are inhabitants of grassy, weed-grown, and brushy locations, mainly in the open country. They are equally at home, however, in the beautiful, grassy, open forests of oak, pine, and firs which clothe the slopes of the great continental mountain system of Mexico and Central America.

In general, they prefer comparatively dry situations, if there is sufficient moisture to produce the needed vegetation, but some species inhabit swamps and even salt- and fresh-water marshes. Although as a rule not very numerous, at times they are abundant and make well-worn trails through the small vegetation in their haunts. They are active throughout the year, and in the North, like some other mice, they burrow through the winter snows along the surface of the ground in search of food.

So far as man is concerned, most of the harvest mice are among the least offensive of mammals. There are exceptions, however, and, although they rarely approach habitations and as a rule take but slight toll from grainfields and meadows, yet in some areas they become so numerous as to do considerable damage.

Their food includes a great variety of seeds, small fruits, and succulent matter mainly from wild plants of no economic value. They lay up stores of seeds in their nests and in little special storage places for severe or inclement weather.

Some of the species dig burrows in the ground where their nests are hidden. Most of them, however, build globular nests of grass and other vegetable matter several inches in diameter in dense grass close to the ground, or up in the midst of rank growths of weeds, or even as high as 8 or 10 feet from the ground in bushes and low trees.

Sometimes they take possession of convenient sites already provided, such as old woodpecker holes, cavities in fence posts, knotholes, and deserted birds' nests, including the nests of the cactus wren and orchard oriole, which they remodel to suit themselves. Their nests are lined with fine, downy material, such as the pappus of the milkweed or the common cat-tail, and have from one to three small openings, usually located on the underside. In these neat homes they have several litters of from one to seven young each year.

Some of their bush nests three or four feet from the ground were found when I was hunting on El Mirador coffee plantation in Vera Cruz. Often as I approached them, the single occupant would dive headlong into the grassy cover below and disappear. But sometimes, when disturbed, they would come out and run about through the tops of the bushes, leaping from branch to branch with all the agility and graceful abandon of pygmy squirrels. Several times they were seen to stop and sit crosswise on the branches with their tails hanging straight down. When they move about among the branches, they sometimes coil the tail around the twig as an opossum might, to give them a more certain hold.

While harvest mice may be seen at their nests by day, they are mainly crepuscular and nocturnal and so retiring in habits that their presence may be entirely overlooked unless special search is made to locate them. Where found, their pleasing ways well repay the observer who has the patience to spend a little time with them.

FLORIDA BEACH MOUSE: Peromyscus polionotus niveiventris and its relatives

(*For illustration, see Color Plate, page* 157)

The beach mouse is a beautiful, velvety-furred little creature about the size of a house mouse and one of the smallest species of the genus *Peromyscus.* Its back is colored with delicate shades of pale vinaceous-buffy and its underparts, including the feet, are snowy white.

The species *Peromyscus polionotus,* of which the beach mouse is one of several geographic races, or subspecies, occupies a comparatively restricted range in the lowland region of Alabama and Georgia and thence through a large part of Florida.

It presents an unusually convincing illustration of the influence of changing environment upon the physical characters of animals. Among the cotton fields of Alabama and Georgia, it is rather dark grayish brown, but on the lighter-colored soil of Florida the color responds and becomes paler in perfect correspondence with the change in soil until the white sand-dunes and beaches of the coast are reached. There, in strong contrast with the color of the northern members of the species, it is so modified that the pale representatives of this area are recognized under the name *niveiventris,* as a geographic race.

Changes in environment affect both great and small mammals in a variety of ways, sometimes in shades of color, sometimes in relative size, and sometimes in proportions. Exceptions to the rule are to be found, however, and some species of mammals have a wide range under a great variety of conditions, with scarcely an appreciable sign of variation.

The beach mouse is abundant on the sand-dunes and beaches of peninsular Florida, especially from Palm Beach to Mosquito Inlet, wherever there is a growth of sea oats (*Uniola*), which appears to be its principal food plant. It is a nocturnal animal and its nightly activities may be read, early in the morning, from the multitude of tiny tracks which lead in all directions and often form a network on the sand. A single track sometimes extends for a hundred yards or more from a burrow, and with all its windings may aggregate several hundred yards of travel, showing the activity of this small worker during many hours.

Tracks are most plentiful immediately about growths of sea oats, patches of saw palmetto, or scrubby bushes. The homes of these mice are usually in short burrows sheltered by growing vegetation or under fallen palm fronds.

As in the case of many of our mammals, we have scanty information concerning the life of these attractive little animals, and it is suggested that here lies a pleasant subject for investigation by some Nature lover wintering in Florida.

WHITE-FOOTED MOUSE: Peromyscus leucopus and its relatives

(*For illustration, see Color Plate, page* 157)

Few of our smaller wild mammals are so generally known as the white-footed mice. Usually a little larger and proportionately shorter-bodied than the house mice, they may at once be distinguished from them by the contrast between the delicate shades of fawn color, brown, or gray of the upper parts of the body, and the snowy white feet and underparts. Like other members of the genus, they have cheek pouches inside the mouth for gathering and carrying food to their stores.

Their exceedingly quick and graceful movements and their beauty of form and color would make them generally attractive were it not for the prejudice against all their kind resulting from the offensive ways of the house mouse.

They are spread over most of the continent from the northern limit of trees to the tropical shores of Yucatan and Panama. One form has the distinction of living up to an altitude of from 15,000 to 16,000 feet on Mount Orizaba, Mexico, where I found its tracks in the volcanic ashes at the extreme limit of vegetation. This is the highest record for any North American mammal.

White-footed mice are active throughout the year and thrive in every variety of situation. In winter, from the Northern States to the Arctic Circle, the snowshoer traversing the forest will note their lacework patterns of tiny tracks leading across the snow from log to log or tree to tree. At sunrise on the southwestern desert their tracks made during the night often form a fine network in the dust, but disappear with the first breath of the morning breeze.

They not only live everywhere in the wilderness, but are prompt to swarm about camps and other habitations, where they make free with the food supplies. Few frequenters of forest camps in the Northern States and Canada have failed to see the bright eyes of these pretty little animals peering at them from some crevice, or the mice scurrying along the log wall like little squirrels.

They are industrious workers. Once in a cabin, they quickly locate a nook in a box or other secluded place in which to construct a warm nest of any soft, fibrous, vegetable material available. This completed, they set busily at work nights to raid the food supply of the owner and hide it in suitable storage places, such as a crevice among boxes, an old shoe, or a pocket in a garment hung on the wall. Their depredations usually cause so much exasperation that the camper overlooks the grace and beauty of his visitors and makes every effort to destroy them. If the occupants of such camps would keep their supplies in mouse-proof containers and would then feed their woodland friends, they would find them quickly responsive and most attractive guests.

In their native haunts these mice have habits which vary with changing conditions. On brushy plains they burrow in the ground, while in the woods they sometimes burrow under rocks, stumps, and logs, or live in hollows in stumps and trees. As nimble in climbing as squirrels, many live in hollow trees sometimes more than 50 feet above the ground.

That our inability to see at night prevents more than an occasional glimpse of the doings of the small animals which often swarm all about us was impressed on me at one of my camps in the desert of Lower California. My blankets were spread under a small leafless tree growing near the base of a rocky ledge, in the crevices of which many relatives of the white-footed mice were living. The first morning in camp I awoke as the sky began to pale and color with the approach of day. The dry branches of the tree a few feet overhead became sharply silhouetted against the sky, revealing several of the mice running up and down them and leaping from twig to twig with all the active grace of tiny squirrels.

The mice appeared to be racing about in pure playful enjoyment of the exercise, and when the light had increased sufficiently to render objects on the ground distinct, they suddenly ran down the tree trunk and vanished in a crevice in the rocks. This game was repeated on several succeeding mornings and is no doubt commonly indulged in where conditions are favorable.

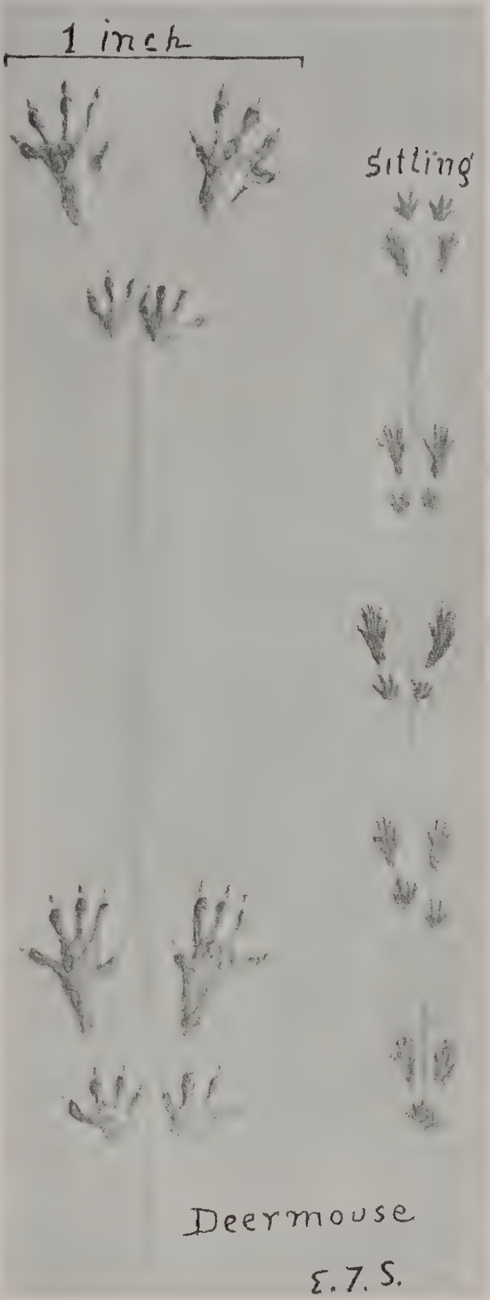
White-footed mice feed mainly on many kinds of seeds and nuts and vary this diet with snails, insects, and sometimes with the flesh of dead birds or other mice. As they do not hibernate, they lay up abundant stores of grain and seeds of many kinds in addition to a variety of nuts, such as acorns, beechnuts, pinenuts, maple seeds, and others, according to the locality. The stores are hidden in hollows in logs, stumps, trees, or in the ground.

When in captivity they have shown themselves expert in catching flies, sometimes capturing them with their teeth and again with their front paws which are used with all the dexterity of little hands.

Several litters of young containing from three to seven each are born, the first usually appearing in spring and the last in fall. The young are blind and helpless at birth, and in this condition cling so tenaciously to the mother's teats that when she is frightened from the nest they are often carried off attached to her.

At least some individuals of the white-footed mice, like others of the Genus *Peromyscus,* are known to have a prolonged and musical song. It is a fine warbling ditty, a little like the song of a canary. A number of good observers have recorded these performances, but they appear to be so infrequent that most people with woodland experience have never heard them.

The lives of these mice are passed in constant fear of a host of enemies. Hawks and owls, blue jays, and shrikes in the bird world are ever on the alert to capture them, while skunks, weasels, minks, foxes, and snakes persistently seek them in their retreats.



FOOTPRINTS OF A WHITE-FOOTED MOUSE

When reduced to scale, the large tracks on the left side are life size, showing the animal making the ordinary bounds of about 3 inches between each set of tracks. In speeding, the space may increase to 12 inches. The tail usually shows in the white-foot, or deer, mouse track, and this, with the pairing of the fore paws, is a strong characteristic.

BIG-EARED ROCK MOUSE: Peromyscus truei and its relatives

(*For illustration, see Color Plate, page* 158)

One of the most striking and picturesque individualities found among the Genus *Peromyscus* is the big-eared rock mouse, which is characterized by its great ears, a thick, soft coat of buffy-brown fur, and a long, well haired tail. In size it exceeds the common house mouse and even the other members of the genus which share its haunts.

This rock mouse is indigenous to the mountainous regions of the West, from Colorado and New Mexico to the Pacific and south to the Cape region of Lower California, and down the Sierra Madre of Mexico to Oaxaca. Within this area it divides into several not very strongly marked geographic races.

As implied by its common name, it is a characteristic dweller among cliffs and ledges along the mountain slopes or rocky canyon walls, where it occupies the many crevices and little caves. In California it ranges from near sea level to above 10,000 feet altitude up on the mountains. Although showing a distinct preference for rocky places, when available, some races of this mouse adapt themselves to other conditions and may be found on brush-grown flats, where they live in brush heaps, old woodrat nests, and similar shelter.

That they make their homes in places other than cliffs in New Mexico was evidenced by a thick, soft nest made almost entirely of wool, found in a hollow juniper. They have several litters of from two to six young each year, the breeding period extending from spring to fall.

In Arizona and New Mexico I found the rock mouse most numerous in the belt of junipers and piñons and in the adjacent yellow-pine forest. The crevices of many of the cliffs about the Hopi and Zuñi Indian pueblos and in all the rocky wilderness of that region, including the Grand Canyon, are abundantly populated with them.

They search every nook about their haunts and often visit cabins or temporary camps for food, but do not usually take up their abode in them as do some of their relatives. When foraging, their movements are quick, and when startled they make surprisingly long leaps.

Like others of their kind, they eat a great variety of seeds and small nuts, quantities of which they lay up in storage for winter. Piñon nuts, and especially juniper seeds, are their favorite food.

While of nocturnal habits, rock mice at times wander forth in sheltered spots by day, and on the few occasions I have seen them I have been delighted with their grace and beauty, their great ears and prominent, shining black eyes lending them an attractive air of alert intelligence.

Throughout their lives they are in deadly peril from predatory foes. Hawks and owls glide shadowlike along the faces of their rocky homes ready to pick them up whenever they venture into open view, while bobcats, skunks, and weasels prowl about by night hunting furry victims.

WHITE-THROATED WOOD RAT: Neotoma albigula and its relatives

(*For illustration, see Color Plate, page* 158)

In the East known as "wood rats," in the West, where much more numerous and better known, these animals are called "mountain rats" or "trade rats." Despite a certain superficial resemblance in size and appearance, wood rats are not related to those exotic parasites, the house rats, with coarse hair and bare tails, but are far more attractive and handsome animals clothed in fine soft fur, delicately colored above in soft shades of gray, buffy, or ferruginous, while below they are usually snowy white or buffy. The tail is fully haired and in some species is almost as broad and bushy as that of a squirrel. Their prominent black eyes and large ears give them an air of vivacious intelligence which their habits appear to confirm.

Wood rats are peculiar to North America, where they occur from Pennsylvania and Illinois to the Gulf coast, spreading thence to the Pacific, as far north as the headwaters of the Yukon, and south through Mexico and Central America to Nicaragua. They are not plentiful in the southern Mississippi Valley and eastward, where they live among cliffs and broken ledges of rock in the deciduous forests, and well deserve their common name. In this region their presence is rarely suspected except by hunters or others familiar with woodland life.

Far more numerous and widely known in the Western States and throughout most of Mexico, they have adapted themselves to life under every climatic condition, from the most sun-scorched deserts of the Southwest and the splendid redwood forests of the humid coastal region in northern California to the tropical lowlands farther south.

They live nearly everywhere on the mountain slopes, even to timber-line at 13,800 feet on Mount Orizaba. They thrive in an extraordinary variety of situations, not only where they may find shelter among rocks, but also where they must seek safety in nests made on the surface of the ground or in burrows dug by themselves. They are prolific animals and each year have several litters containing from two to five young.

The presence of wood rats is generally indicated by accumulations of odds and ends filling the crevices of the rocks in the vicinity of their retreats or piled about the entrances of their burrows. Such accumulations include small sticks, pieces of bark, laeves, cactus burs, bones, stones, and any other small objects which may be found in the vicinity.

Sometimes these piles seem to be made merely for amusement or to work off surplus energy. They consist of useless objects, such as heaps of small stones, frequently a bushel or more, piled on the rounded tops of small protruding bowlders in open desert areas, or small heaps of sticks and other material scattered aimlessly about their haunts.

In the desert where cacti of many kinds abound wood rats' nests are often made at the bases of these or other thorny plants and are covered with such a protective coating of cactus burs as to deter the most insistent enemy. In the heavy forests of northern California, wood rats build on the ground huge conical nests of sticks, which are several feet in diameter and rise to a height of five feet or more.

In southern California and elsewhere some species make great nests of sticks 8 to 20 feet from the ground in live oaks and other trees. The stick-pile nests on the ground usually have several entrances, with trails leading from them, and the underground burrows usually have two or more openings.

As may be surmised from their habits, wood rats are skillful climbers, both in trees and on the rough rock walls of the cliffs they inhabit. Their only notes appear to be shrill squeaks and squeals when quarreling among themselves at night. They also express annoyance or alarm by a rapid drumming on the ground with their hind feet, just as is done by some of the hares and rabbits.

On Santa Margarita Island, in Lower California, I found the most curiously located habitations of these animals I have seen, the bulky stick nests being placed well back in the midst of a mangrove thicket growing in a tidal lagoon. At high tide the mangroves were isolated from shore by several rods of water, so that only at low tide were the rats able to go ashore dry-footed. In going back and forth they followed certain irregular lines along adjacent, nearly horizontal mangrove stems, the discoloration on the bark plainly indicating the routes which finally led to dry land by little trampled roads across the muddy ground bared by the tide.

Back a little way from shore, others of the same species were living in burrows guarded by orthodox stick and trash-pile nests among the cacti.

Wood rats, especially in northern localities, gather stores of piñon or other nuts, potatoes, corn, and any other nonperishable food available to meet the season of storms and scarcity, concealing these supplies in cavities in the nests either above or below the ground. They eat many kinds of fruits, seeds, leaves, and other parts of plants, sometimes including bark of shrubs or small trees and even cactus pads.

As a rule, each nest is occupied by a single rat, but sometimes several may be found in one, and the well-worn trails that so often connect the entrances of neighboring nests bear evidence that the inhabitants have a social disposition. In most localities wood rats are distributed sparingly, but occasionally become so abundant in favorable places on brushy plains that colonies containing hundreds of nests may be found in limited areas. They sometimes increase about ranches until they make serious inroads on grain and other crops. They also give the Forest Service much trouble by digging up the pine seeds planted in their great reforesting nurseries.

Wood rats are mainly nocturnal in habits and appear to be extremely active throughout the night. Each morning in the vicinity of their nests the light soil shows a multitude of tracks, and in places I have seen little roads in the sand several hundred yards long which they had made by repeated trips to a feeding ground.

No sooner is a cabin built in the mountains than they move in and establish themselves under the floor, or locate a nest near by and use the house as their nocturnal resort. Throughout the night the patter of their busy feet may be heard as they race about on the floor or rustle about the roof, and often over the sleeping forms of their unwilling hosts.

Their activities are sources of mingled amusement and vexation. Small, loose articles, including table knives, forks, and spoons, vanish and all manner of trash, including horse droppings, are brought in, thus establishing their title to the cognomen of "trade rats." If the owner of a cabin leaves it for a few days, he may find on his return that the rats have taken possession and during his absence have tried to fill it with trash of all kinds, in order to make a comfortable home for themselves.

At a cabin in the mountains of New Mexico where I lived one summer, several mountain rats made free of the place and at night persistently tried to add our shoes to their nest under the floor. An hour or so after retiring, we would hear our shoes scrape slowly across the floor, and in the morning they would be found stuck toe down in the broad crack where the floor ended near the wall. In the wood-rat country, when small articles are missed from camp it is always worth the trouble to investigate the nearest rats' nests.

Wood rats are plentiful on the Mexican tableland, making their nests under cacti or thorny agaves, where they are persistently hunted as game by the natives, who prize them as a special delicacy. I saw them regularly sold in the markets of the cities of San Luis Potosí and Aguas Calientes, where the method of marketing them was unique. As soon as they were dug from their nests, their lower incisors were broken off close to the jaw to render them powerless to bite, and then the rats were placed alive in a strong sack and carried to town.

The vendor would sit on a curb at the market and either kill and dress them there or shout his wares by telling every one who passed that he had "country rats, very delicious; live ones; fat ones; very delicious, very cheap." The natives all praised their delicate flavor and one I had served me as a special courtesy was really good, tasting like young rabbit.

ALASKA BROWN LEMMING: Lemmus alascensis and its relatives

(For illustration, see Color Plate, page 160)

Brown lemmings inhabit most of the Arctic and subarctic lands of both Old and New Worlds. In North America they are known from the far-northern tundras to the southern end of Hudson Bay, and throughout most of northern Canada and all of Alaska, including the islands of Bering Sea.

The extraordinary migrations of these lemmings attracted attention far back in the early history of northern Europe. At intervals, through favorable conditions, they become superabundant over a large area, and then a sudden resistless desire to migrate in a certain direction appears to seize the entire lemming population. The little beasts start in a swarming horde, sometimes containing millions, and traverse the country.

In their travels they appear indifferent to all obstacles and with dogged and unwavering persistence swim the streams and lakes encountered on their way. Similar migrations have been observed at various points in Arctic America, several of them in Alaska, where the lemmings abound on the open tundras.

These migrations sometimes continue for more than one season, the animals meanwhile being killed in countless numbers by disease, by accident in field and flood, and, in addition, through the heavy toll taken by their winged and four-footed foes, which always gather in numbers to accompany them.

The migrations sometimes wear out through the diminution in numbers, and sometimes when they reach the sea, as in Norway, they are said to enter the water and swim offshore until they perish. When one of these swarms of rodents passes through a farming district, it cleans up the crops and other surface vegetation like a visitation of locusts.

Brown lemmings do not hibernate, but, active throughout the severest winters, are abroad almost equally by day and by night. Their burrows consist of winding tunnels, often many-branched and with more than one opening. A dry bed of peat or a dense growth of moss is often pierced by a network of them. Well-defined runways often lead away from the burrows or from the entrance of one burrow to that of another.

Their tunnels run everywhere under the snow, with occasional passages leading to the surface. When fierce gales blow away the snow or a winter rain melts it, many lemmings lose touch with their burrows and wander about until they perish from cold or are caught by some enemy. They are sometimes found several miles from shore, having strayed out on the sea ice.

In winter in the fur countries, in company with field mice, they invade storehouses and habitations in search of food. Among their enemies are ravens and all northern hawks and owls, as well as foxes, weasels, lynxes, bears, and other beasts of prey of all degree.

Within their underground tunnels and often in dense vegetation on the surface, lemmings make warmly lined nests of grass and moss in which their young, from two to eight in number, are born. The young appear at varying times, thus indicating several litters each year.

When taken alive, the old ones are fierce and courageous, growling and fighting savagely; but several half-grown young brought me during my residence in Alaska proved to be most amusing and inoffensive little creatures. From the first they permitted me to handle them without offering to bite and showed no signs of fear.

They were kept in a deep tin box, from which they made continual efforts to escape. When I extended one finger near the bottom of the box they would stand erect on their hind feet and reach up toward it, using their forepaws like little hands. If my finger was lowered sufficiently, they would climb up into my hand and thence to my shoulder, showing no sign of haste, but much curiosity, continually sniffing with their noses and peering at everything with their bright, beadlike eyes.

They were curiously expert in walking on their hind feet, holding the body in an upright position and taking short steps. If anything was held just out of reach above their heads, as the tip of my finger, they would continue in an erect position for a considerable time. At such moments they would reach up with their front paws and often spring up on their hind feet for half an inch above the floor trying to touch it. When eating they sat upright on their haunches, like little marmots, and held the food in their front paws.

ALASKA COLLARED LEMMING: Dicrostonyx rubricatus and its relatives

(*For illustration, see Color Plate, page* 160)

Collared lemmings are unique among the mouse tribe in their change from the rufous brown, or gray summer coat to pure white in winter. With the assumption of the white winter fur, a thick, horny, padlike growth develops on the underside of the two middle claws of the front feet, which is molted in spring when the winter coat is lost. For an animal living in the Far North the usefulness of a white coat in winter is evident, but no good reason is apparent for these curious claw-pads.

The summer coat varies remarkably in color and color pattern, and many of the lemmings in their beautiful shades of chestnut, browns, or grays are very handsome. They are more heavily proportioned than field mice and the very long fluffy fur, which completely conceals the rudimentary ears and tail, tends to exaggerate their size.

The collared lemmings form a strongly marked group, containing a number of species inhabiting circumpolar regions. In North America they occur nearly everywhere in the Arctic and subarctic parts, such as Greenland, most of northern Canada, with the Arctic islands, and a large part of Alaska, including some of the Aleutian Islands.

They range as far northward as vegetation affords them a proper food supply. To the southward they extend into the subarctic forests, where they usually keep to the more open barren areas.

They are mainly nocturnal and live in burrows from two to three feet long, ending with a nest chamber four or five inches in diameter, lined with grass and moss. Near the nest there is usually a branch burrow a foot or more long which is used for sanitary purposes and as a place of refuge when the main burrow is invaded.

In the nests during early summer litters generally containing about three young are brought forth. Ordinarily the burrows open in unsheltered places, but in wooded regions they may be under a log or beneath a bush or the roots of a tree. No runways lead out from the burrows, as is customary with many of their relatives. They are active throughout the winter, making many tunnels along the surface of the ground under the snow, which are revealed when it melts in spring.

These surface tunnels are their foraging roads, safe from most of the fierce storms which rage overhead. At times, however, the snowy shelter is blown away or some other cause brings the lemmings to the surface, where they blunder aimlessly about, soon to be captured by some enemy or to perish from the cold. As their infrequent appearance on top of the snow is usually during storms, the Alaskan Eskimos have a legend that these white lemmings live in the land above the stars and descend in a spiral course to the earth during snowstorms.

Although collared lemmings never become so numerous over great areas as the brown species, they become abundant at times in the Barren Grounds of Canada and the Arctic islands and migrate from one part of their range to another. The best observation in regard to this was made by Rae in June at the mouth of the Coppermine River, where he encountered thousands of them speeding northward.

The ice on some of the smaller streams had broken up and he was amused to see the little animals running back and forth along the banks looking for a smooth place in the stream, indicating a slow current, where they could swim across. Having found such a place, they at once jumped in and swam quickly to the opposite side, where they climbed out and, after shaking themselves like dogs, continued their journey.

During the years I lived in northern Alaska, the advent of winter was marked by invasion of the storehouses by many brown lemmings and other mice, but collared lemmings rarely appeared. When occasionally captured alive, the old ones fought viciously, but the young were gentle and quickly became tame and interesting pets. Their skins were highly prized by the little Eskimo girls to make garments and robes for their walrus ivory dolls.

OREGON RUFOUS TREE MOUSE:
Phenacomys longicaudus and its relatives

(*For illustration, see Color Plate, page* 170)

So far as known, the living members of the Genus *Phenacomys* are confined to the boreal parts of North America, where they range from the Atlantic to the Pacific in Canada, and southward along the mountains to New Hampshire, New Mexico. and northern California.

All but one species of the genus live on the ground, inhabit burrows, make runways through the small vegetation, and feed on grasses and other herbage—all in close conformity with the habits of the meadow mice.

The tree mouse, however, is a strongly aberrant member of the group. It differs from all the others, and from all field mice, not only in its rufous color and longer tail, but in its remarkable mode of life. It is restricted to the humid region of magnificent forests in western Oregon and northwestern California, where it often spends its life in the tops of such noble trees as the Sitka spruce, the Douglas fir, and the coast redwood. Such an amazing departure from the habits of its kind lends unusual interest to this little animal.

Its nests are generally located high up in the trees, sometimes 100 feet from the ground, in forests where the branches of neighboring trees interlace so that it can pass from one to another and inhabit a world of its own, free from the ordinary four-footed enemies which prowl below.

The nests vary in size, structure, and location. In Oregon they have been found only in large trees at elevations varying from 30 to 100 feet. On the seashore near Eureka, California, they are placed on the branches of small, second-growth myrtle and redwood trees. Farther inland in the same region many are in small trees, within a few yards of the ground, on the border of heavy redwood forests.

The higher nests of the tree mice are often the deserted and remodeled homes of the big gray tree squirrel of that region (*Sciurus griseus*) and contain a foundation of coarser sticks than in the nests wholly built by the mice. The larger proportion are built by the mice themselves and are usually composed of small twigs, fragments of a netlike lichen. skeletons of fir, spruce, or other coniferous leaves, and the droppings of the mice themselves. They vary from small oval structures a few inches in diameter, located well out on the branches, to great masses close against and sometimes entirely surrounding the tree trunks, supported on several branches, and measuring three feet long and two or three feet high.

The interiors of these large structures are pierced with numerous passageways and sometimes as many as five separate nest chambers are scattered through one. Tunnels run out along each of the limbs on which the mass rests, and if it extends all the way around, one main tunnel encircles the trunk from which these hallways branch.

Such great nests have evidently been used for a long period and have grown with the steady accumulation of material. This has gradually decayed and become a solid mass of earthy humus.

The large nests are usually the abodes of a single female; the homes of the males are small and more often located away from the trunk of the tree. The food of the red tree mouse, so far as known, consists entirely of the fleshy parts of fir and spruce needles and the bark from coniferous twigs.

Tree mice appear to breed throughout most of the year and have from one to four young in a litter. They are mainly nocturnal.

That these mice sometimes descend to the ground of their own volition is probable, but the fact that the stomach of every individual so far examined has contained only the fleshy parts of coniferous leaves indicates that their food habits have become so fixed as to make arboreal life a necessity.

The modification of the habits of a member of a group of ground-frequenting animals, with a structure adapted to such an existence, to those of a strictly arboreal animal, is so strange as to make the question of cause a puzzling one.

In the Hawaiian Islands the introduction of the mongoose has made the common house rat arboreal in habits, and possibly in the remote past the pressure of some ground-frequenting enemy thus affected the lives of the red tree mouse.

CHAPTER X

Red-backed Mice, Meadow Mice, Pine Mice, Muskrats, House Rats and Mice, Mountain Beaver, Jumping Mice, and American Porcupines

THE Order *Rodentia* includes the species of this chapter, as well as those of Chapters VII, VIII, and IX.

The red-backed mice, Genus *Evotomys,* and the field mice, Genus *Microtus,* are both of circumpolar distribution, ranging in Europe and Asia from the treeless Arctic tundras well south. In North America they are rather generally distributed south to the northern border of the United States. Thence the several species and subspecies occur south along the mountains to North Carolina, New Mexico, and California.

The field mice are more generally distributed and occur along mountains to Guatemala. They are blunt-headed, heavy-bodied mice with short legs and tails, varying in color from grizzled brown to dull grayish. They are most numerous in damp places, where an abundant growth of grasses is available. Everyone familiar with meadows and old fields in the eastern United States knows these diminutive beasts by sight, as they dart along their little runways. They are so responsive to environment that about 90 species and subspecies are known on this continent.

Pine mice, Genus *Pitymys,* are close relatives of the meadow mice, *Microtus,* and occur only in eastern North America, mainly in the United States from the Mississippi Valley to the Atlantic. Two species and three subspecies are known, all from the area named, except one species living on the mountains of western Vera Cruz, Mexico. They are much like meadow mice in their proportions and habits, but have a more glossy or silky fur.

MUSKRATS MORE CLOSELY AKIN TO MEADOW MICE THAN BEAVERS

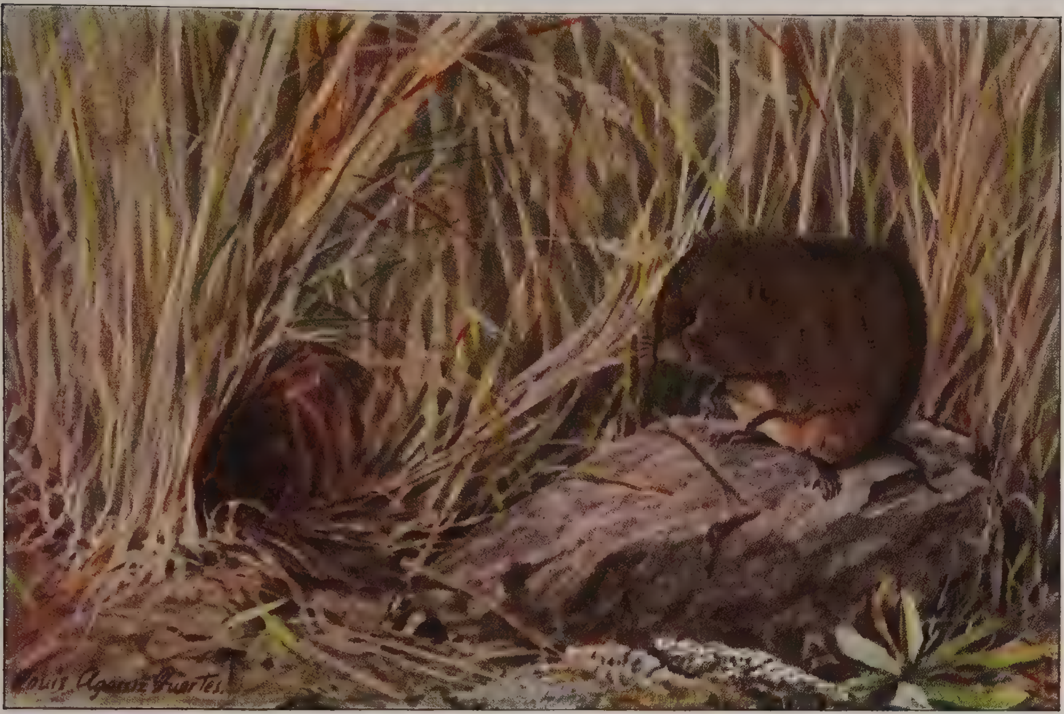
Muskrats, Genus *Ondatra,* are among the most interesting of our distinctively American mammals. The genus contains one species and 13 subspecies, which are distributed over most of North America from the mouths of the Rio Grande and the Colorado Rivers north to the treeless Arctic tundras of Canada and Alaska. Their distribution and habits are singularly similar to those of the beaver, but their real structural relationship is with the meadow mice. A fine fur and peculiar amphibious habits have made the muskrat a widely known member of our fauna.

Members of the Family *Muridæ,* consisting of Old World rats and mice, represent a number of genera and occur in practically all parts of the Old World. They vary considerably in size, appearance, and habits. One desert genus has its hair changed to flattened spines and one occurs in Australia, where it is one of the exceedingly few mammals not a marsupial. The common house rats and mice were native of Asia, but have been carried to all parts of the world during the progress of commerce. These are the only members of the family in America, where they are too well known as destructive pests mainly about man's habitations.

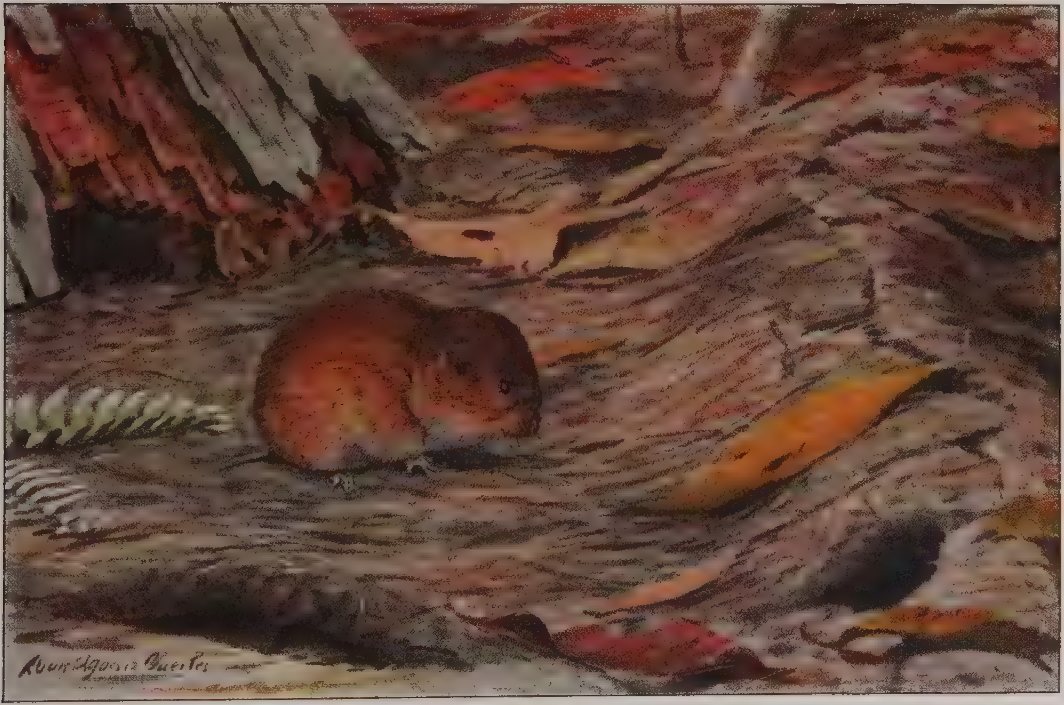
Numerous species of house mice, Genus *Mus,* and of the house rats, Genus *Rattus,* occur in the Old World, where they are widely distributed. Only one species of the common house mouse has appeared in America, where it has become generally distributed. Three species of house rats occur here as in many other parts of the world.

The mountain beaver belongs to the Family *Aplodontiidæ,* an American group of mammals, occurring only in extreme western America. It is a short, round-headed, round-bodied, tailless animal formed on the general lines of a large, tailless muskrat, to which, however, it is not structurally related except in a very general way. Neither has it any near relatives among existing American mammals.

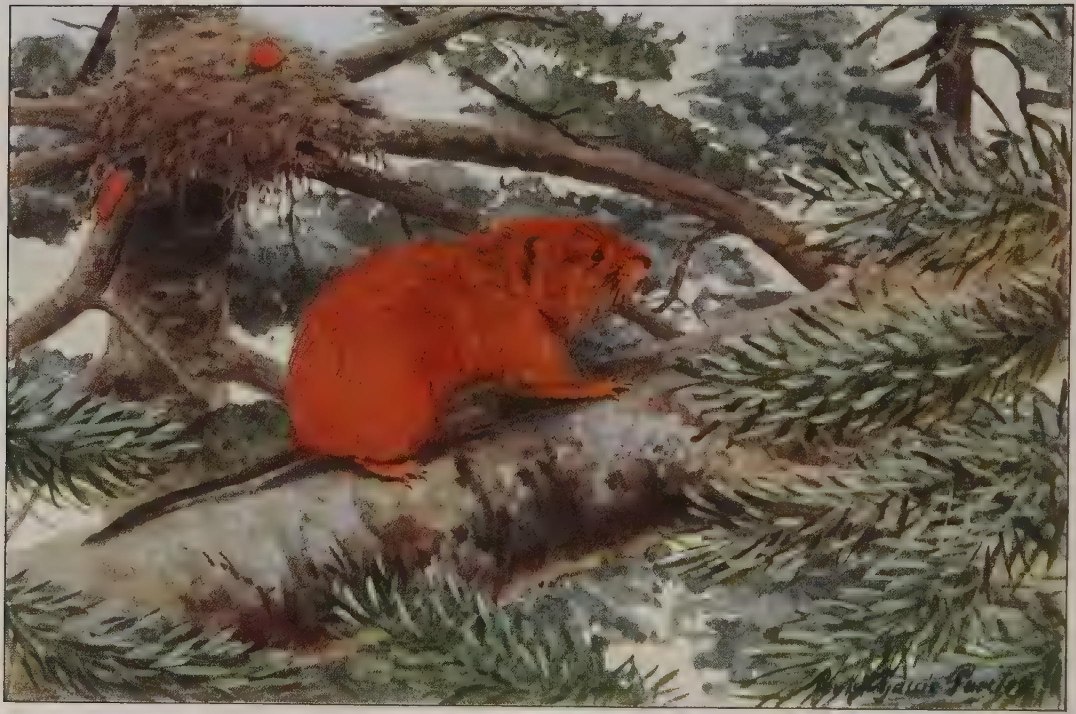
The mountain beaver family and Genus *Aplodontia* contain only a single species with its nine subspecies, which are confined to a comparatively limited belt along



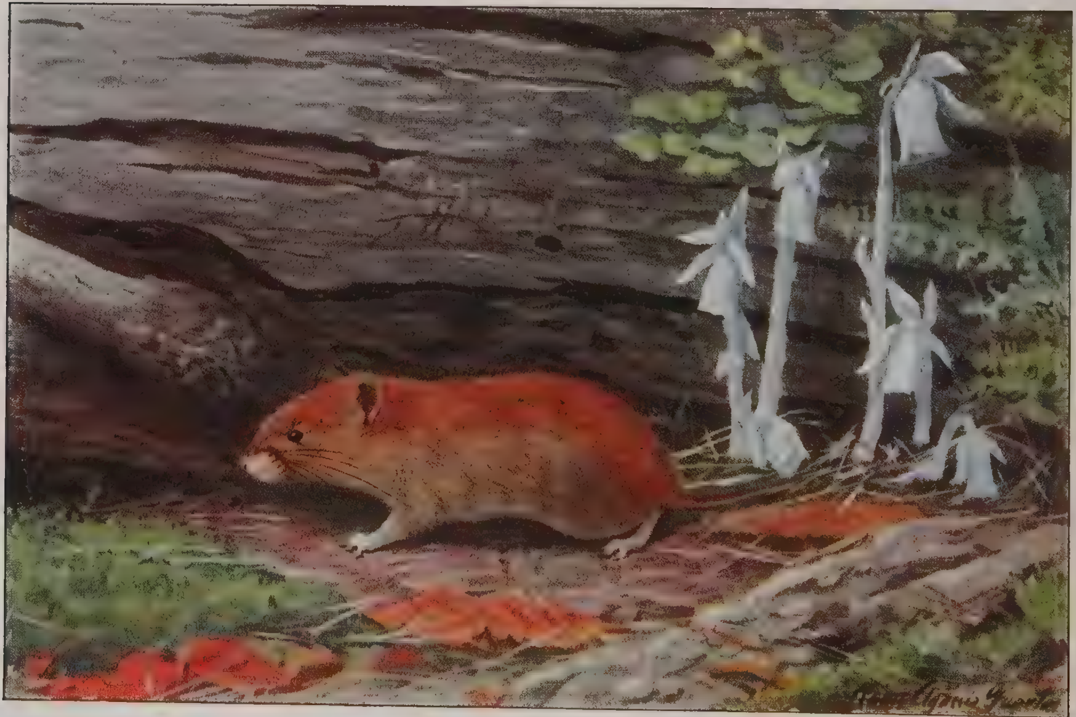
EASTERN FIELD, or MEADOW, MOUSE
Microtus pennsylvanicus



GEORGIA PINE MOUSE
Pitymys pinetorum



OREGON RUFOUS TREE MOUSE
Phenacomys longicaudus



CANADIAN RED-BACKED MOUSE
Evotomys gapperi

the Pacific coast from British Columbia to the southern Sierra Nevada in California.

JUMPING MICE OCCUR ONLY IN NORTH AMERICA

So far as is known, jumping mice, members of the Family *Zapodidæ,* occur only in North America and the interior of China, where a single species has been taken. In North America occur two closely related genera, *Zapus* and *Neozapus,* the members of which are much alike in size, appearance, and habits. They are all characterized by their light, slenderly built bodies, with greatly developed hind legs for leaping, and an extraordinarily long tail. They have much the general form of the kangaroo rats of the Genus *Dipodomys,* but are really related in structural characters to jerboas, those small, Old World jumping animals of arid regions.

Common jumping mice, Genus *Zapus,* are generally distributed in Canada and Alaska within tree limits and southward to North Carolina, Colorado, and the southern Sierra Nevada. Within these limits these mice vary so much that 20 species and subspecies have been recognized. In parts of eastern Canada and the eastern United States, the closely related Genus *Neozapus* also occurs.

American porcupines, of the Family *Erethizontidæ,* differ strikingly from their relatives so well known in many parts of the Old World. The American animals have very much shorter quills and longer tails and are more arboreal in habits. Two genera occur, of which the common porcupine of the United States, *Erethizon,* is well known. In Central and South America are the prehensile-tailed porcupines of the Genus *Coendou.*

Few animals in North America are better known than the common American porcupine, Genus *Erethizon,* a curious sluggish beast armed with a bristling coat of little spines. Two species and five subspecies have been named by naturalists, but they are very similar in size, general appearance, and habits. They range from the tree limit in the North south across the continent to Pennsylvania, Kansas, and the southern Sierra Nevada.

CANADIAN RED-BACKED MOUSE: **Evotomys gapperi** and its relatives

(For illustration, see Color Plate, page 170)

With the exception of the collared lemmings, the red-backed mice are the most brightly colored of the smaller northern rodents. They are close relatives of the common field mice, which they about equal in size, but from which they are distinguished externally by rufous coloration, finer and more glossy pelage, larger ears, and proportionately longer tails.

The red-backed mice form a group containing a considerable number of species distributed throughout the northern circumpolar lands, except on the barren islands of the Arctic Ocean. In North America they occur from the Arctic tundras north of the limit of trees southward throughout Alaska and Canada to the northern United States. With other northern species of mammals, birds, and plants, they follow the high mountain ranges still farther southward to North Carolina, New Mexico, and middle California.

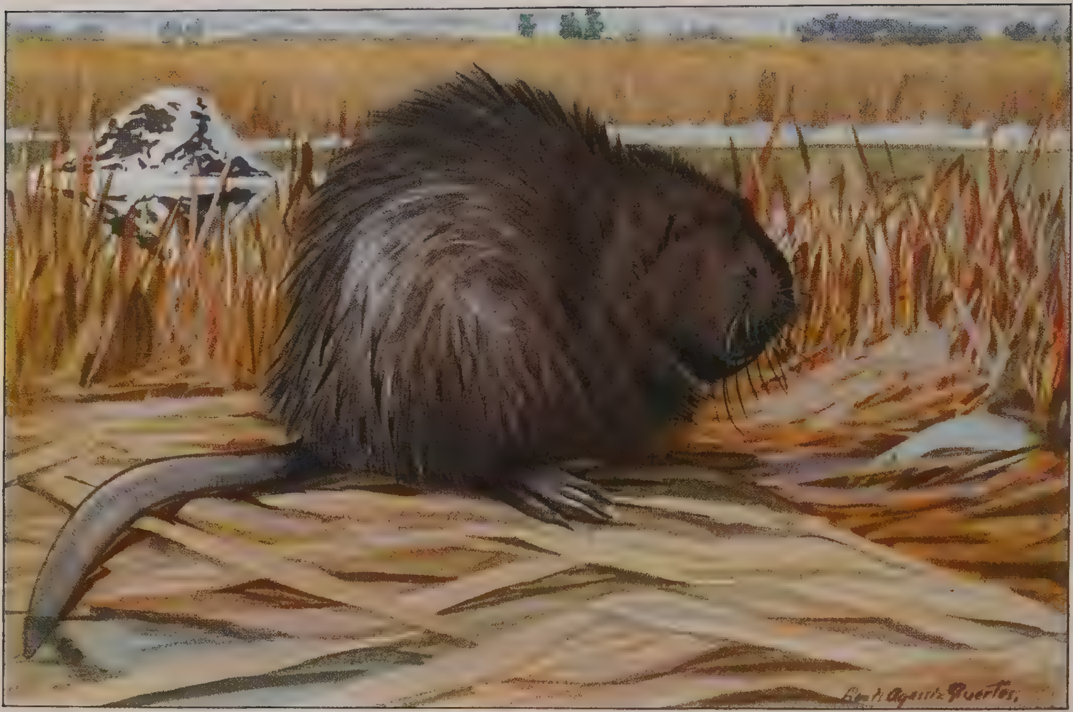
It is true that in the Far North they are numerous on the moss-grown tundras, and in the South range above timber-line on high mountains. As a general rule, however, they are woodland animals, whether among the spruces, birches, and aspens of the North or farther south in the United States on the cool fir and aspen-clad slopes of mountains. They also frequent old, half-cleared fields, brush-grown or rocky areas, and similar places where cover is abundant.

Although so closely related to the field mice, the red-backed species are not known to become excessively abundant nor seriously to injure crops. One reason for their harmlessness in this respect may be their strong preference for forest haunts.

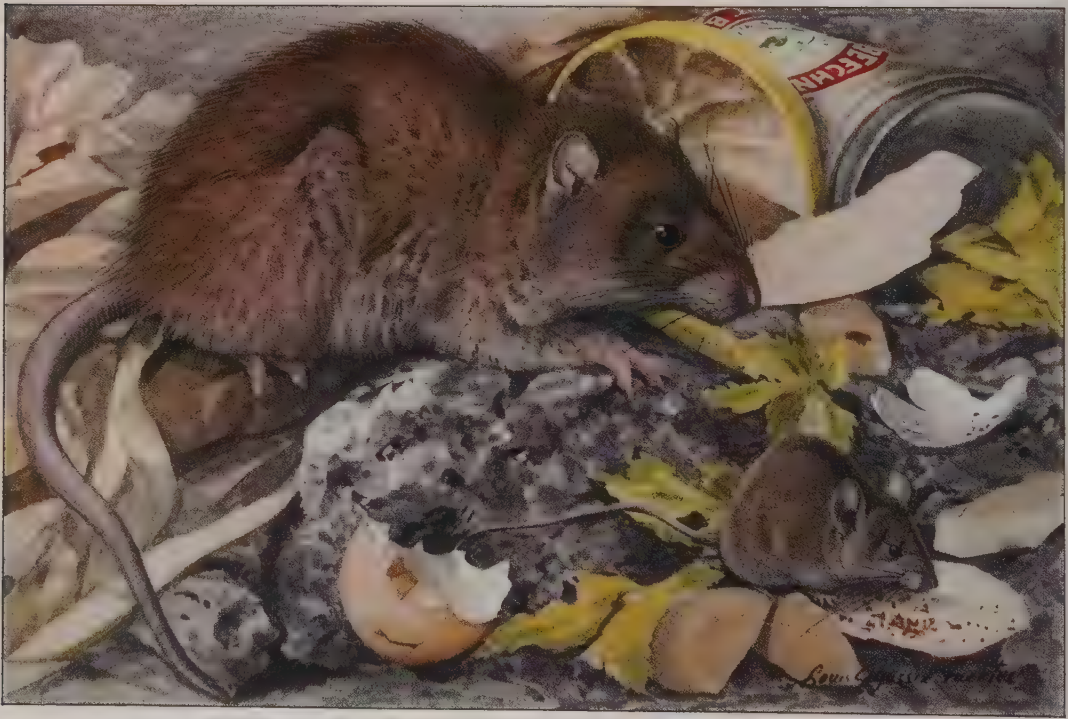
I once found them numerous in the grass-grown streets and yards of an abandoned mining camp in the forest at the head of Owens River, in the Sierra Nevada of California. The mice were making free use of the congenial shelter afforded by the old log cabins, and their runways and entrances to burrows were all about under scattered boards and similar cover.

They are abroad equally by day and by night, and for this reason are better known to woodsmen than most of the small woodland animals. When foraging by day among the fallen leaves and deep green vegetation, they present a most graceful and attractive sight, now moving about with quick and pretty ways, now pausing to sit up, squirrellike, to eat some titbit held in the front paws, and then on the alert to detect a suspected danger and poised in quivering readiness for instant flight.

Red-backed mice usually live in underground burrows similar to those of field mice, but generally located with more care in dry situations. The entrances are sheltered by a stump, log, root of a tree, rock, or other object. Ordinarily they do not make such well-defined runways as do many field mice, and sometimes no trace of a trail can be found leading away from their burrows. But where they travel about through small, dense vegetation, under logs and



MUSKRAT
Ondatra zibethica



BROWN, or HOUSE, RAT
Rattus norvegicus

HOUSE MOUSE
Mus musculus

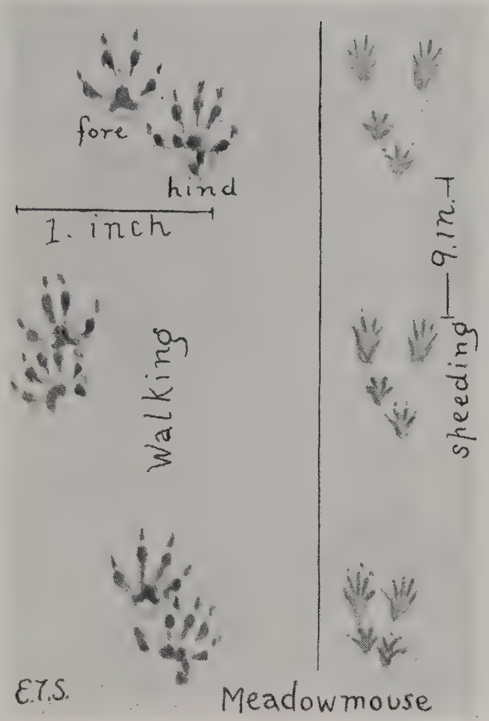
about stumps and rocks, they often make well-marked trails.

Their nests are bulky and formed of a mass of fine dry grass, moss, and other soft material, which is sometimes located in an underground chamber opening off the burrow and sometimes in hollow stumps and logs or under other surface shelters. But little is known about the home life of these mice except that they are prolific, and between April and October have several litters containing from three to eight young in each.

They feed upon a great variety of seeds, fruits, roots, and succulent vegetable matter and lay up stores for winter in underground chambers or in hollow logs and similar places above ground.

With the coming of winter, they gather about cabins and other habitations in their territory and become as persistent as house mice in searching out and raiding food supplies of all kinds. When the more appreciated kinds of food fail, they resort to gnawing the bark from roots and bases of trunks of small deciduous trees of various kinds.

During my sledge journeys in the region about Bering Strait, I found the skins of many red-backed mice among the Eskimo children. The small boys kept them with lemming skins as evidences of their prowess with miniature deadfall traps and blunt-pointed arrows, and the little girls kept them as prized robes for the dolls carved by their fathers from wood or walrus ivory.



THE TRAIL OF A FIELD, OR MEADOW, MOUSE

When compared with that of the white-footed mouse (see page 163), one notes the absence of the tail mark and the rarity of the forefeet being paired.

EASTERN FIELD, OR MEADOW, MOUSE: **Microtus pennsylvanicus** and its relatives

(*For illustration, see Color Plate, page* 169)

The Pennsylvania meadow mouse is a small species about as long in body as the house mouse, but much more heavily proportioned. Its head is rounded, the eyes small and bead-like, the legs and tail are short, and the comparatively coarse fur is so long that it almost conceals the short, rounded ears.

It is a typical representative of a group of small mammals commonly known as "field mice," or "bear mice," which includes a great number of species closely similar in general appearance, but varying much in size. In England they are termed "voles," and large species living about the water in England and northern Europe are known as "water rats."

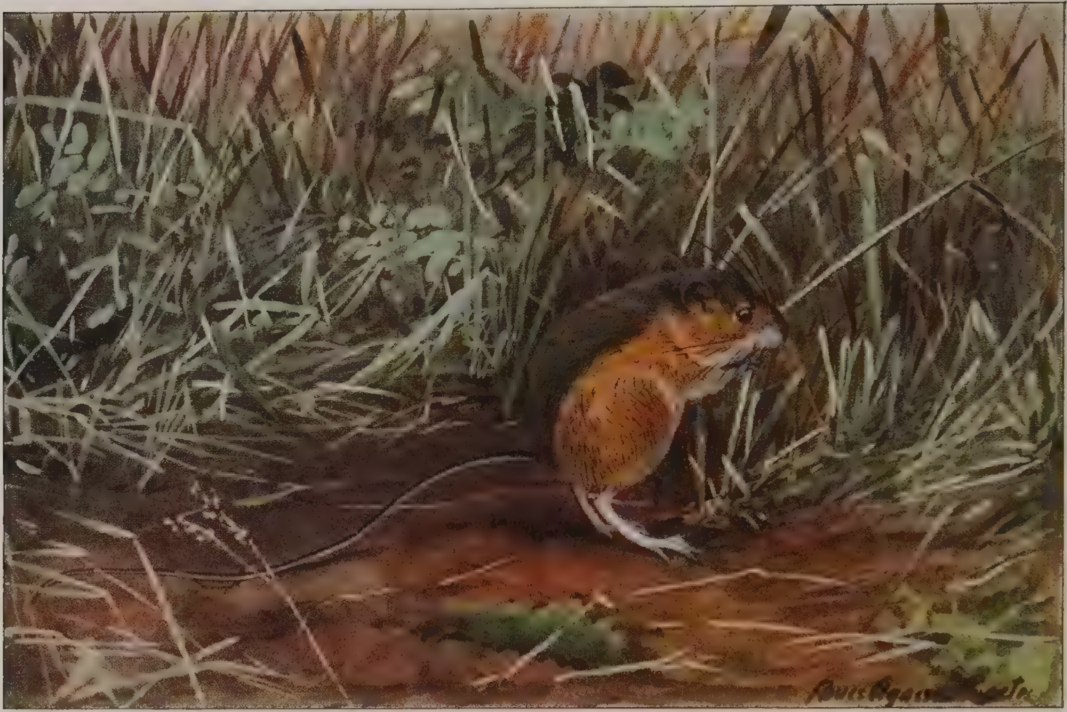
As a rule, field mice prefer low-lying fertile land, as grassy meadows, but the banks of streams, the rank growths of swamps and marshes, the borders of damp woodlands, the grassy places on Arctic tundras, or the dwarfed vegetation of glacial slopes and valleys above timber-line on high mountains, furnish homes for one species or another.

Two, and even three, species of field mice are sometimes found in the same locality, but each kind usually occupies a situation differing in some way from that chosen by the others. Some occupy comparatively dry ground and others, like the European water rat, live in marshes and are almost as aquatic as the muskrat. Most species living about the water are expert in diving and in swimming, even under water. In streams inhabited by large trout, they are often caught and eaten by the fish.

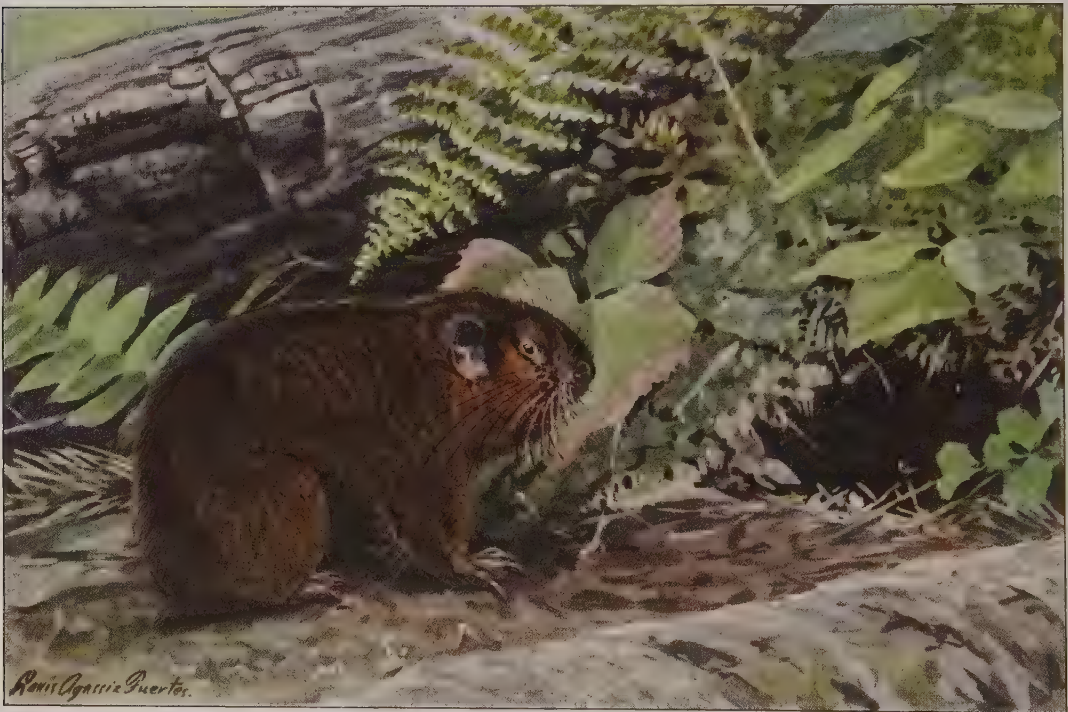
The presence of field mice is nearly always indicated by smoothly worn little roads or runways about an inch in width, which form a network through the vegetation in their haunts. These runways lead away from the entrances of their burrows and wind through the vegetation to their feeding grounds. They are kept clean and free from straws and other small obstructions, so that the owners when alarmed may run swiftly to the shelter of their burrows. Fully conscious of their helplessness, meadow mice are as cautious as the necessities of existence will permit.

Their burrows are often in the midst of grassy meadows, as well as under the shelter of logs, rocks, tussocks of grass, or roots of trees, and lead to underground chambers filled with large nests of dry grass, which shelter the owner in winter and often in summer. The summer nests in many places, especially in damp meadows or marshes, are made in little hollows in the surface or in tussocks of grass. In these nests several litters containing from 4 to 11 young are born each year.

It is rarely that an observer is located where he can study the everyday lives of little animals


Louis Agassiz Fuertes

COMMON JUMPING MOUSE
Zapus hudsonius


Louis Agassiz Fuertes.

POINT REYES MOUNTAIN BEAVER
Aplodontia rufa phæa

like the meadow mice and at the same time go on with his regular occupation. At one of my mountain camps in Mexico, I fortunately pitched my tent on a patch of lawnlike grass in front of the ruins of an abandoned hut. Runways of field mice formed a network everywhere in the surrounding growth of grass and weeds.

For hours at a time as I worked quietly in the tent the many mice, unconscious of my presence, came silently along their little roads through the tall vegetation to the border of the short grass. Just within the shelter of the tall growth, they would each time stop and remain watchfully immovable for a half minute, and then, if everything was quiet, make a swift run two or three feet into the open, bite off a tender little grass blade and dash back to the sheltered road. There they would sit up, squirrellike, holding the grass blades in their forepaws and eating them rapidly, or would sometimes carry the food back to the burrows.

Occasionally, as the mice darted into the open, I made a slight squeaking noise and perhaps two or three in sight at the time would instantly turn and dash back into the sheltered road, sometimes not reappearing for a long time. Again and again I saw them come into the open for food, and before securing it suddenly scamper back in a panic without apparent cause for alarm.

Eternal vigilance is the only defense such animals have, and despite their watchfulness myriads of them are devoured daily by a large number of rapacious birds and mammals, including even such huge beasts as the great Alaskan brown and grizzly bears, which dig them from their burrows on grassy northern mountain sides.

Despite their numerous natural enemies, field mice are so prolific that they continue among the most destructive of agricultural pests. They are so obscure and the damage by a single mouse appears so insignificant, that it requires a knowledge of their habits, their wide distribution, and their enormous numbers to appreciate what a serious drain they are on the farmers' income, even when in their normal numbers.

In summer they feed on growing grass, clover, alfalfa, and grain, seeds, bulbs, root crops, and garden vegetables. In fall they congregate under shocks to feed on the grain, and in winter often do enormous injury to young or even well-grown fruit and other trees by gnawing off the bark on the base of the trunk and roots, sometimes in this way destroying entire orchards and nurseries.

One species in California destroys large quantities of raisins drying in the field by carrying them off to some shelter, where they cut out the seeds and leave the rest of the fruit. I have seen half a pound of raisins under a piece of board, the result of the night's work of a single mouse.

While field mice are always destructive, at intervals they have sudden and mysterious accelerations of increase and become so excessively abundant that they are a veritable plague. Many instances of this are on record in the Old World, where they have become so destructive as to call forth governmental intervention.

The most notable recent outbreak of this kind in the United States took place in the Humboldt Valley, Nevada, where, during the winters from 1906 to 1908, they swarmed over the cultivated parts of the valley and completely destroyed 18,000 acres of alfalfa, even devouring the roots of the plants.

During this outbreak the mice in the alfalfa fields were estimated to number as high as 12,000 to the acre.

Whenever field mice become overabundant, notice appears to go out among their natural enemies, and in extraordinary numbers hawks, owls, crows, ravens, sea gulls, coyotes, foxes, bobcats, weasels, and other animals appear to prey upon them.

At no season of the year are they free from their foes, for they remain active throughout the winter, and most species apparently lay up no winter store of food. They travel to winter feeding places through series of tunnels under the snow, and it is mainly at this season that they do the most serious damage to orchards and shrubbery.

In the Far North at the beginning of winter they gather in large numbers about the fur-trading stations and other habitations, where they persistently invade the food supplies.

Some of the northern mice, however, gather stores of food for winter. A species living along the coast of the Bering Sea and elsewhere on the Arctic tundras of Alaska accumulates a quart or more of little bulbous grass roots, which are delicious when boiled. They are hidden in nests of grass and moss among the surface vegetation, and before the first snowfall I have seen the Eskimo women searching for them by prodding likely places with a long stick. The roots thus taken from the mice are kept to be served as a delicacy to guests during winter festivals.

GEORGIA PINE MOUSE: **Pitymys pinetorum** and its relatives

(*For illustration, see Color Plate, page* 169)

Most of the pine mice are limited to the wooded region of the States between the Atlantic coast and the eastern border of the Great Plains, and from the Hudson River Valley and the border of the Great Lakes south to the Gulf coast. Strangely enough, one species lives in a restricted belt covered with tropical forest along the middle-eastern slope of the Cordillera, which forms the eastern wall of the Mexican tableland, on the border between the States of Vera Cruz and Puebla.

Pine mice occupy the borders of thin forests and brushy areas, from which they work out into the open borderlands, especially in orchards or other places where there are scattered trees amid a rank growth of weeds. Instead of making their runways among growing vegetation on the surface of the ground, like field mice, they live in little underground tunnels or burrows which extend in all directions through their haunts. These tunnels closely resemble those of the common mole, except that they are smaller and have numerous openings to the surface, through which the owners make short excursions for food. They frequently utilize the tunnels of moles when conveniently located for their purposes.

The tunnels are often so near the surface that the ground is slightly uplifted or broken as by a mole, or they are made under the fallen leaves and other small decaying vegetable matter coving the ground under the trees. Occasionally, when the surface soil becomes dry and hard, the burrows are deeper, so that no surface indications can be discovered.

On account of the similarity of their burrows, the depredations of pine mice are commonly attributed to moles.

Several inches below the surface pine mice excavate oval chambers to be used for nests or for storage purposes. These chambers have several entrances from ramifying tunnels and are filled with short, fine pieces of grass, making a warm nest-ball. Here the several litters of young are born each year. Pine mice are less prolific than field mice, however, and the litters contain only from one to four young.

The food chambers are larger than the nest chambers, and when full of stores are kept closed with earth. In these are stored short sections of green or dry grasses, bulbous grass roots, and short sections of other edible roots. One such store contained about three quarts of the fleshy roots of a morning-glory cut into short sections.

Pine mice obtain much of their food from the bark about the bases and roots of trees, including both coniferous and deciduous species. They kill many small trees and shrubs by girdling, or by cutting the roots below the surface, and in this way frequently inflict severe damage in orchards and nurseries. Owing to their underground habits they are much more dangerous to orchards than field mice. They also do much damage by burrowing along rows of potatoes and other root crops, upon which they feed.

Both pine mice and field mice are serious pests to agriculture and only by vigilant care can they be prevented from steadily reducing the returns from farm and orchard. A mouse appears so insignificant an enemy that the general inclination among farmers is to ignore it, but both field and pine mice exist in such enormous numbers and are so generally distributed that the aggregate annual losses from them are great.

Clean cultivation in orchards, especially for some distance immediately about the trees, is an excellent protective measure against both of these mice. The shrubbery and fruit trees of orchards, lawns, and gardens may be protected by the use of poisoned baits and traps as soon as signs of pine mice or field mice are observed.

MUSKRAT: Ondatra zibethica and its subspecies

(*For illustration, see Color Plate, page* 172)

The muskrat, or "musquash," as it is widely known in the northern fur country, is three or four times the size of the common house rat, to which it bears a superficial resemblance. It has a compactly formed body, short legs, and strong hind feet partly webbed and otherwise modified for swimming. The long, nearly naked, and scaly tail is strongly flattened vertically and in the water serves well as a rudder. The fur is nearly as fine and dense as that of the beaver and, as in that animal, protects its owner from the cold water in which so much of its life is spent.

Muskrats are peculiar to North America, where they exist in great numbers. Aquatic in habits, they have a wide distribution along streams of all sizes and among marshes, ponds, and lakes from the Atlantic to the Pacific, and from a little beyond the limit of trees on the Arctic barrens south throughout most of the United States. They reach our southern border at the Delta of the Mississippi and the Delta of the Colorado, at the head of the Gulf of California.

Within this vast area they have been modified by their environment into several species and geographic races, none of which differ much in appearance from the well-known animal of the Eastern States.

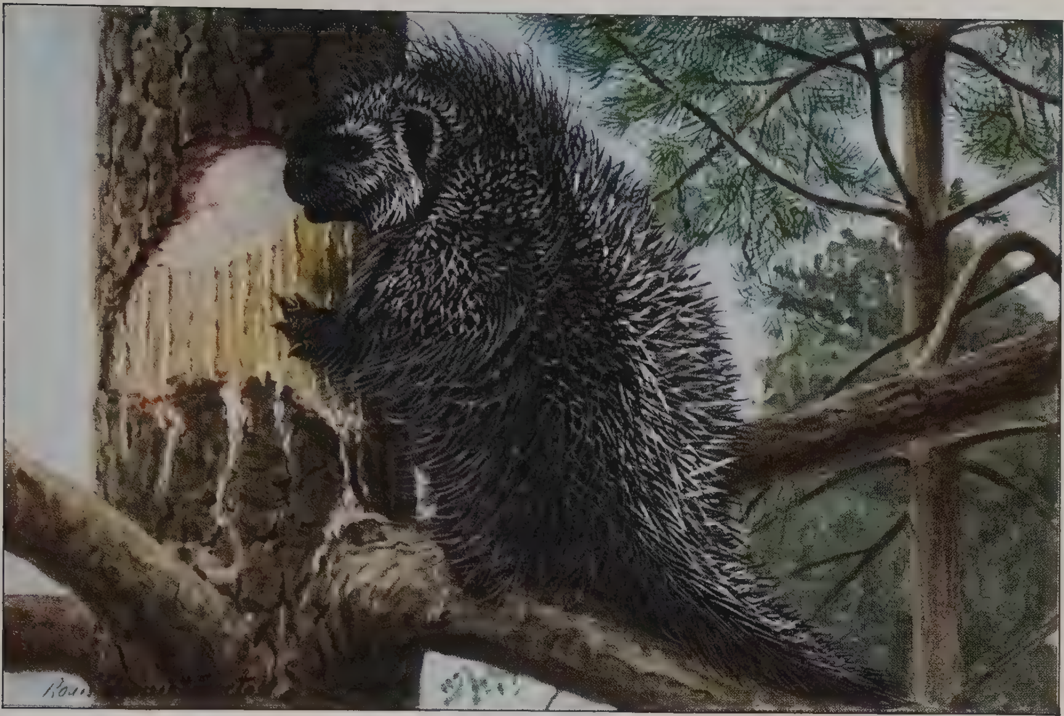
The nearest kin of the muskrats are the short-tailed field mice, so numerous in our damp meadows. Like the latter, the muskrat has several litters of young each season. The young are born blind, naked, and helpless, and number from 3 to 13 in a litter. This great fecundity has enabled the muskrats to hold their own through years of persistent trapping.

They still occupy practically all their original range and yield a steady toll of valuable fur each season. In 1914 more than 10,000,000 of their skins were sold in London, and other millions were handled in America. The aggregate returns on muskrat skins are so great as to constitute it our most valuable fur bearer. Furriers make the skins up in their natural color or dress and dye them and give various trade names.

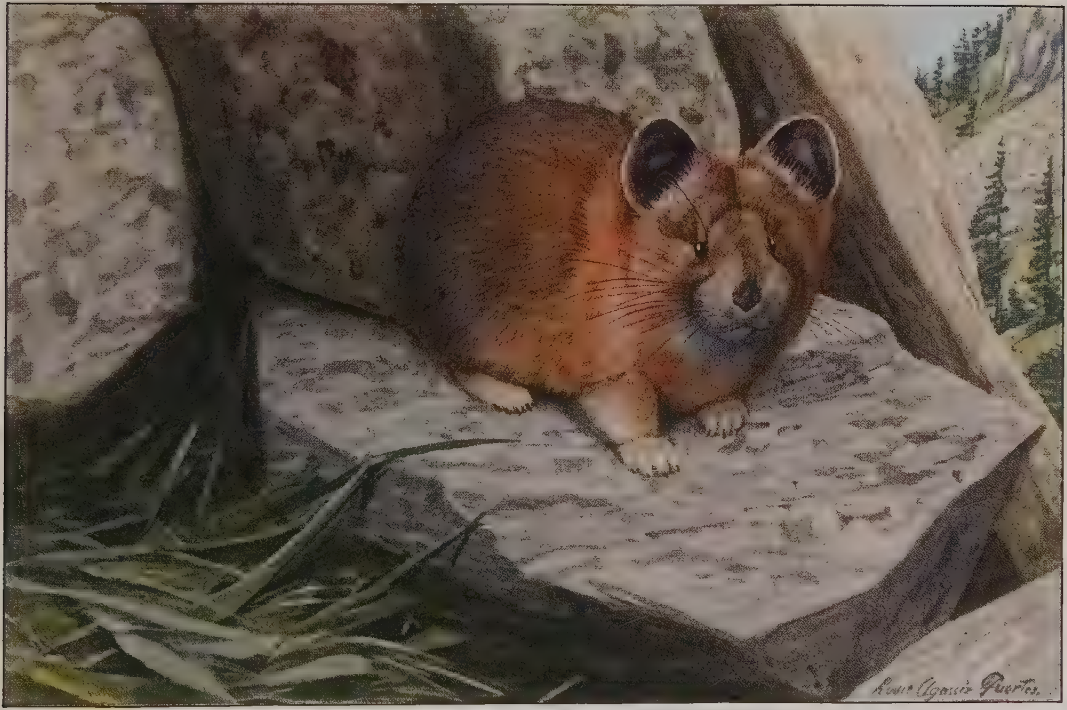
In suitable marshes, as on the Eastern Shore of Maryland, muskrats become extremely abundant and render such areas valuable as natural "fur farms." One Maryland marsh containing 1,300 acres has yielded from $2,000 to $7,000 worth of skins a year. Not only are the skins of value, but the flesh is palatable, and is sold readily under the trade name of "marsh rabbit" in the markets of Baltimore, Philadelphia, and elsewhere. Muskrat farming has become a recognized means of making marsh areas yield an income. In southern Louisiana one such area contains more than 1,000,000 acres.

There is little doubt that owners of favorably situated marshes are deriving a steady revenue by keeping them stocked with proper food plants and protecting the muskrats from their enemies. The value of these fur bearers is becoming more and more appreciated and many States have laws restricting the trapping season to a period in fall and winter, when the fur is prime, and containing provisions for licensing muskrat farms.

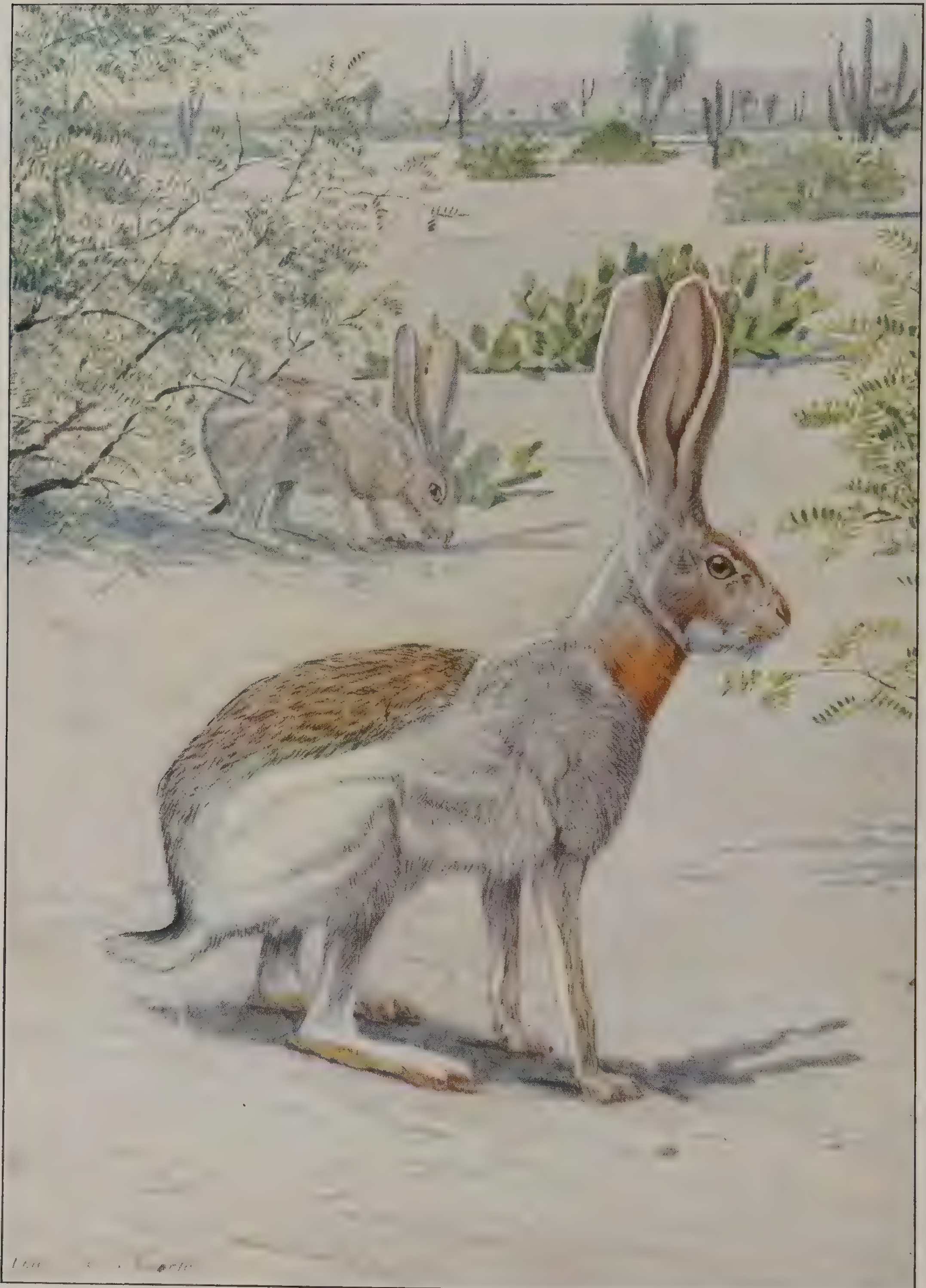
In marshes about shallow lakes or bordering sluggish rivers muskrats build roughly conical lodges or "houses," three to four feet high, with bases, usually in shallow water, several feet broader. These houses are made of roots and stems of plants with a mixture of mud. An oval chamber is left in the interior, well above the water level, to which entrance is gained by one or more passageways opening under water. These shelters are mainly for winter use, but the young are sometimes born in them as well as in large grass nests among dense marsh vegetation.



CANADIAN PORCUPINE
Erethizon dorsatum


Louis Agassiz Fuertes.

PIKA, or CONY
Ochotona princeps



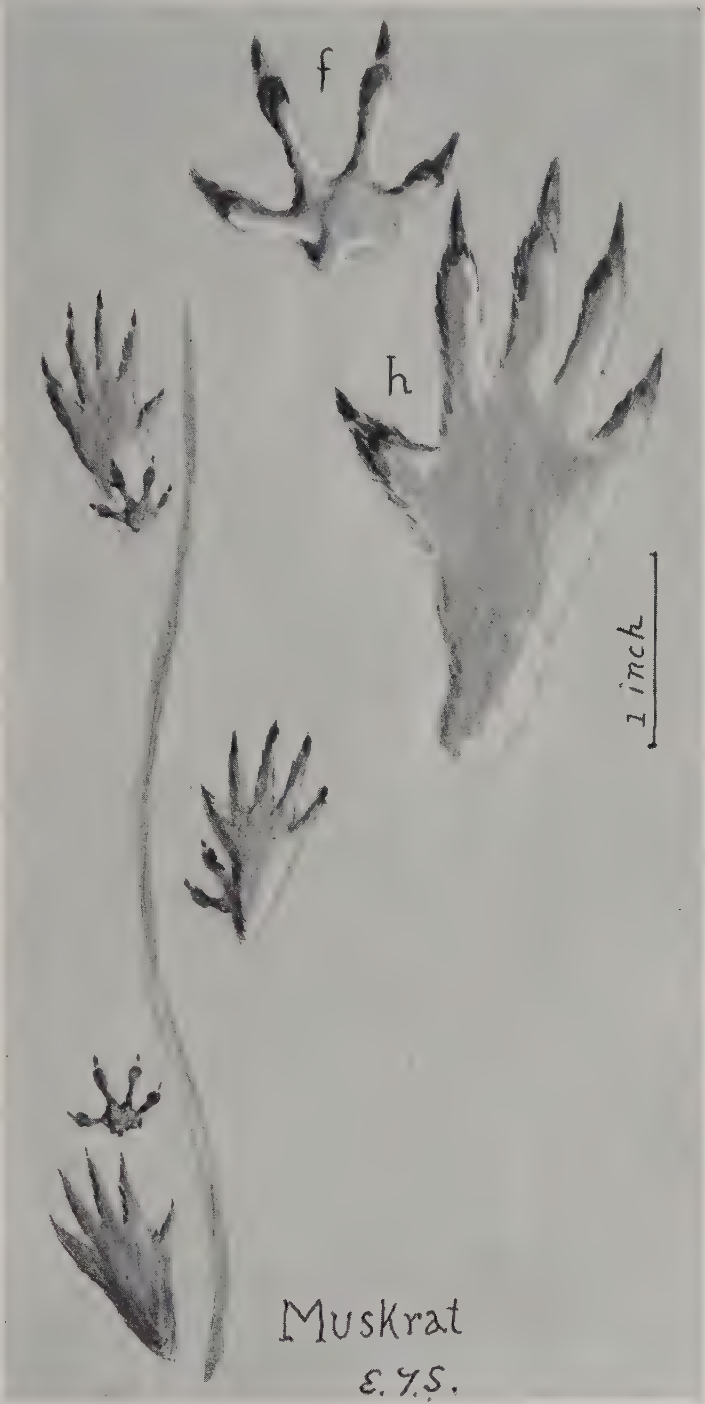
ANTELOPE JACK RABBIT
Lepus alleni

The curious conical lodges are familiar objects about marshes in the Eastern and Northern States, and a few years ago I remember seeing a specially well-formed muskrat house close to the historic bridge at Concord, and others along the Concord River. Until the land was reclaimed, within recent years, muskrat houses were common in marshy ponds in Potomac Park, Washington.

Where the banks of streams or lakes rise abruptly, the muskrats make their homes in dry chambers in the banks above water level at the end of a tunnel opening either under water or close to the water level. Worn trails lead up the banks about such places and well-marked runways are made through the heavy reeds and marsh grasses in their haunts.

Muskrats are mainly nocturnal animals, but often move about during the day. I have seen them repeatedly swimming close to the bank of the Potomac a short distance above Washington. They like to carry their food to slightly elevated points where they can overlook the water along shore, such as the top of a projecting log, large stone, or earthen bank, from which they plunge headlong at the first alarm. Many a solitary canoeman gliding silently along the shore of stream or pond at night has been startled by the disproportionately loud splash made by a muskrat diving from its resting place.

Their food consists mainly of the roots and stems of succulent plants varied with fresh-water clams, an occasional fish, and even by cultivated vegetables grown in places readily accessible from their haunts. They store up roots and other vegetable matter for winter use and remain active throughout that season. The roots of which their



THE TRAIL OF THE MUSKRAT

The usual gait of the muskrat on land is a slow walk. The tail mark is always very strongly shown. Comparison of this track with that of the raccoon on page 58 is of special interest.

"houses" are built are frequently those used for food and sometimes serve as winter supplies.

As a rule, muskrats keep near their homes in winter, making excursions here and there beneath the ice. Sometimes the water rises and forces them out and they wander widely in search of new locations. When encountered at such times, they show extraordinary courage and fiercely attack man or beast. The first muskrat I ever saw was one which a farmer met in midwinter in a snowy road in northern New York. As soon as the man drew near, the animal rushed at him with bared teeth and fought savagely until killed.

Muskrats are usually harmless animals and their presence in marshes and along watercourses lends a pleasant touch of primitive wildness to the most commonplace situations. They appear to have so adapted their habits to the presence of men that they go on with their affairs with curious indifference to their human neighbors. In irrigated country or other regions where banked ditches are built, their habits render them serious pests, as their burrows and tunnels drain ponds or cause destructive washouts.

An interesting chapter in the history of these animals began in 1905, when four Canadian muskrats were introduced on a nobleman's estate in Bohemia. Since then they have increased rapidly and spread over a large area in Bohemia and beyond its borders. The streams in the region they occupy are controlled by grassy banks, and dams are built to form ponds for fish culture, which is a large industry there. The muskrats persistently tunnel into the banks and dams, causing them to give way, thus causing heavy losses to the owners.

They also work havoc among river crabs and mussels, which have great economic value, and interfere with the fish and their spawning beds. To cap the climax of their misdeeds, they are reported to feed on grain and vegetables and to destroy the eggs of domestic poultry and of wild fowl. It is reported also that these expatriates in their foreign environment have become larger animals than their ancestors, and that their fur has greatly deteriorated in quality. The measures prescribed by the Agricultural Council of the Kingdom of Bohemia for their control as a pest were apparently without much success. This instance is a good illustration of the danger attending the introduction of an animal from its native habitat into a new region.

BROWN RAT, OR HOUSE RAT: Rattus norvegicus and its relatives

(*For illustration, see Color Plate, page* 172)

It is safe to assume that few readers need an introduction to that world-wide pest variously known as the "brown rat," "house rat," "wharf rat," or "Norway rat." Two European relatives, the black rat and the roof rat, preceded the brown rat to the New World and became widely distributed. They resemble the brown rat, but are much smaller and are soon killed, driven away, or reduced to a secondary status by their larger and fiercer cousin, which averages about 16 inches in length, although large individuals attain a length of more than 20 inches and a weight of more than two pounds. The black rat has nearly disappeared from most of its former haunts in the United States and the roof rat is mainly restricted to southern localities with a mild climate, which does not appear attractive to the brown rat.

Neither the brown, black, nor roof rat has any near relatives among native rats of America, and all may be distinguished from our native animals by their coarser hair and long, naked tails.

The brown rat is believed to have first invaded Europe from Asia in 1727, when hordes of them swam the Volga River, and about the same year it arrived in England on ships from the Orient. Since then, traveling by ships and by inland commercial routes, it has spread to nearly all parts of the globe. In the New World it is now established in human abodes throughout the length and breadth of the land, from Greenland to Patagonia.

Wherever it goes, the fierce and aggressive spirit with which it is endowed more than qualifies the brown rat to hold its own against all rivals, while its mental adroitness and its fecundity have largely nullified the constant warfare being waged against it by all mankind. Not content with infesting ships, dwellings, stores, warehouses, and even the refrigerating rooms of cold-storage plants in many areas, it has established itself as an extremely destructive pest in the open fields.

In towns it hides among stored merchandise, in the hollow walls of buildings, in sewers and other underground passages, or when in the fields, in burrows which it digs in the ground. Its nests are soft, warm masses of fibrous material which is secured by raids on any available supply of cotton, wool, or fabrics, which it cuts into shreds for the purpose.

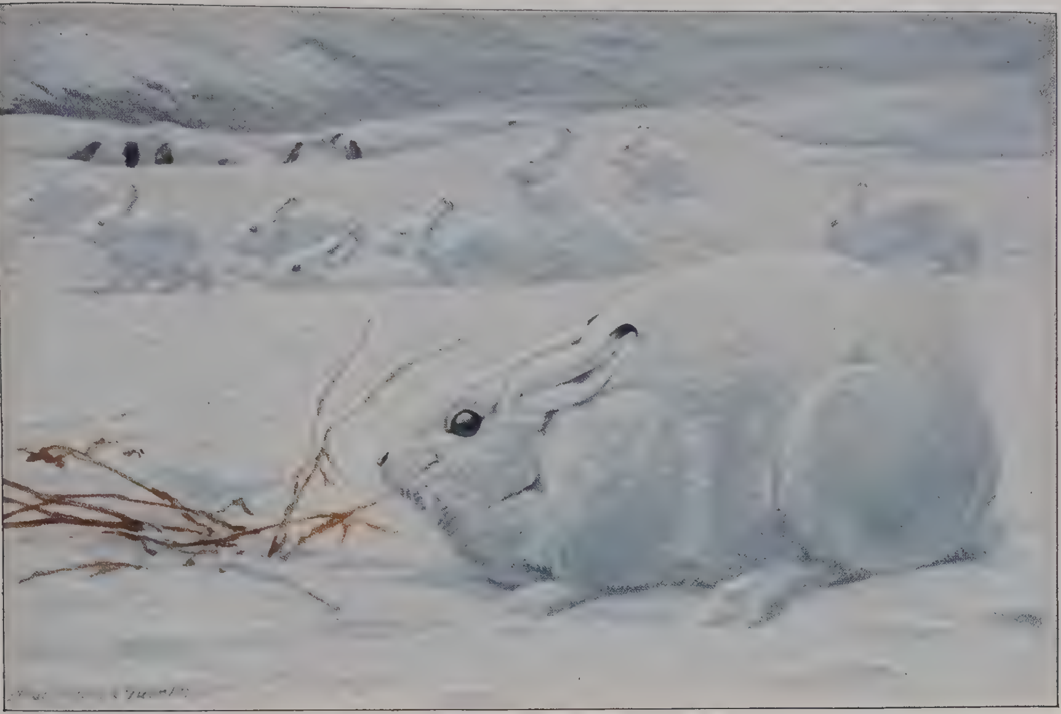
In these retreats it has several litters a year, averaging about 10 young, but exceptional cases of more than 20 young have been recorded. The young begin to breed when less than six months old. The size and number of litters increase with the food supply, and under favorable conditions rats soon become intolerable pests.

In Jamaica and the Hawaiian Islands rats became so numerous that sugar-cane and other plantations were at one time threatened with complete destruction. To save the crops the mongoose was introduced, but after checking the rats in Jamaica these curious little mammals in turn became a pest which it appears hopeless to control.

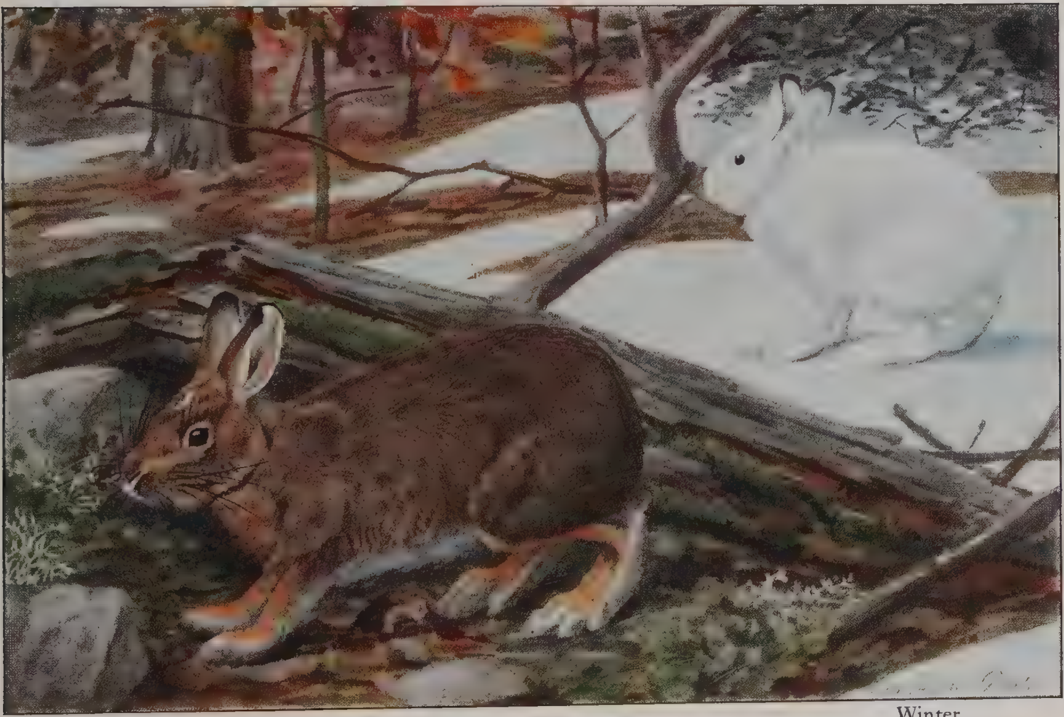
In the Hawaiian Islands the mongoose reduced the number of rats, but the survivors promptly took up their abode in the tree tops, where they now live as completely arboreal lives as squirrels, safe from their ground-inhabiting enemy.

During a two weeks' campaign against rats in the sewers of Paris, 600,000 were killed, and on a rice plantation of about 1,200 acres in Georgia 30,000 were destroyed in one season. In Illinois 3,435 were killed on a farm in one month.

One of the most curious chapters in the life of this hardy beast is now developing in the far island of South Georgia, on the border of

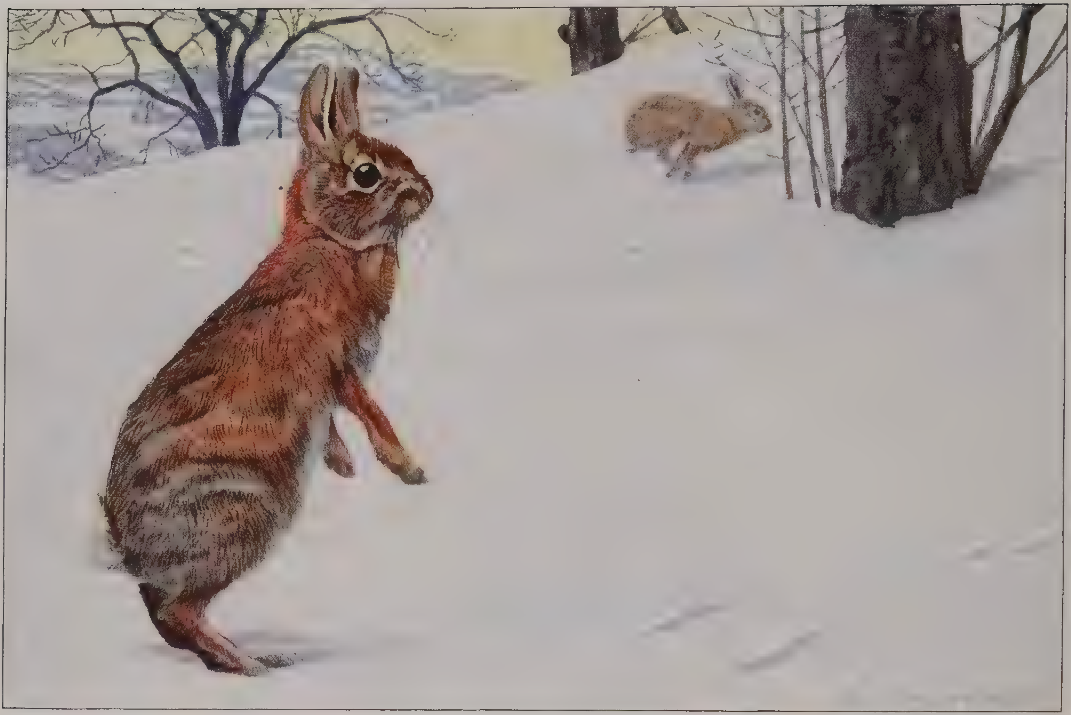


ARCTIC HARE
Lepus arcticus

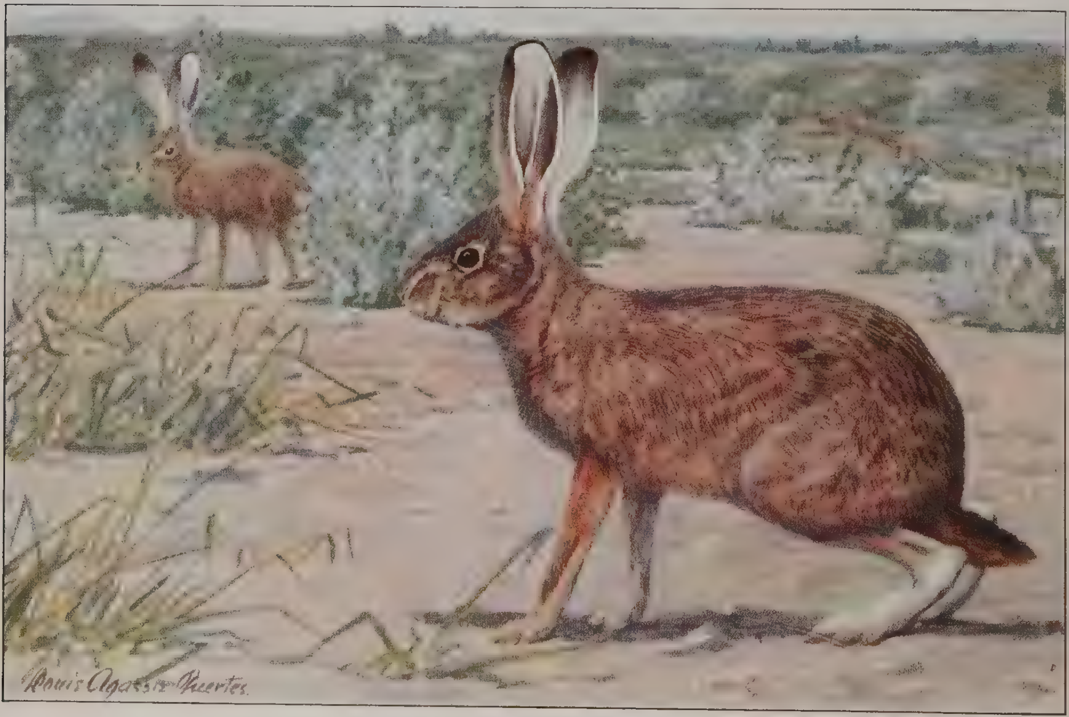


Summer Winter

VARYING HARE, or SNOWSHOE RABBIT
Lepus americanus



COTTONTAIL RABBIT
Sylvilagus floridanus


Louis Agassiz Fuertes

CALIFORNIA JACK RABBIT
Lepus californicus

the Antarctic, east of Cape Horn. On this island, which has a cold and stormy summer and nine months of rigorous winter, several whaling stations have been established. For years great numbers of whale carcasses have drifted ashore each season and, half rotting, half refrigerated, have furnished a never-failing food supply for brown rats that have landed from the ships. With such abundant food, they are reported to have increased until they now exist there literally in millions. They make their nests in the tussocks of grass and peat and swarm along well-marked trails they have made on the mountain sides.

In the trenches along the battle front in France during the World War, they became extremely abundant and troublesome. In England they have multiplied so greatly that the Board of Agriculture is fostering efforts to destroy them as a menace to the public welfare through their waste of food supplies. Other European countries, especially France and Belgium, are warring against them.

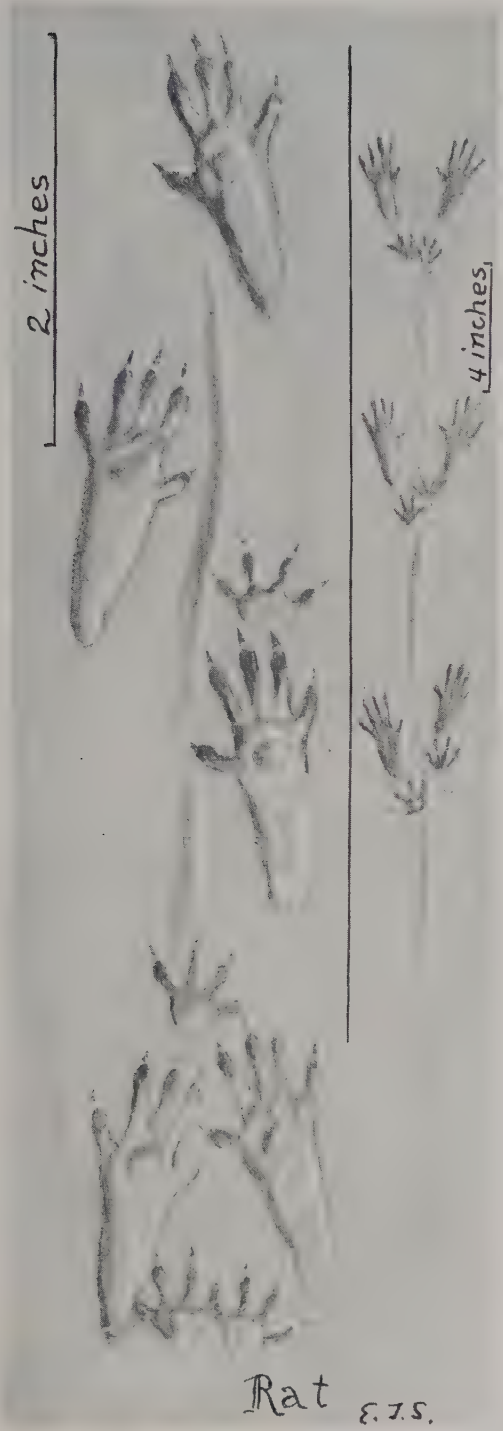
On farms, in addition to destroying growing and stored crops, they kill great numbers of young chickens, turkeys, and other poultry, and create havoc with such ground-frequenting game as pheasants. At all times brown rats are more or less carnivorous, and when several are confined in a cage the stronger will soon kill and devour the weaker.

In city department stores and large hotels they often cause thousands of dollars' worth of damage yearly in single establishments. An English organization for their destruction estimated in 1908 that, outside the towns and shipping, in Great Britain and Ireland they caused annual losses of about $73,000,000. Losses from them in the United States has been estimated at about $200,000,000 annually, equaling the economic earnings of about 200,000 men. The U. S. Department of Agriculture is conducting a national educational campaign for their control.

When there is a sudden diminution in the food supply, an abundance of which has caused a great increase in the rat population, the rats migrate into other districts, sometimes in enormous numbers. These migrations usually occur at night, and many are matters of history in Europe and in the United States.

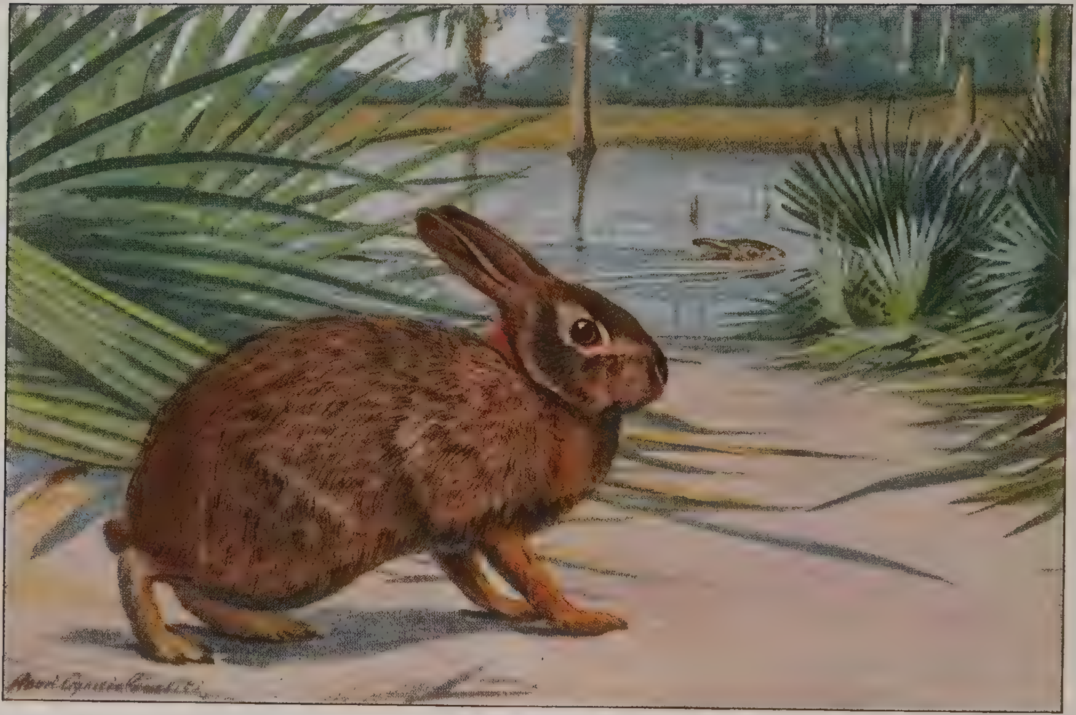
A witness of one of these migrations in Illinois in 1903 reported that one moonlight night, as he was passing along the roads, he heard a rustling in a field near by and soon saw crossing the road in front of him a multitude of rats extending as far as he could see. The following year the invaders became a plague in that district. At times of food scarcity rats become extremely bold and aggressive. Without hesitation they swim across streams encountered in their wanderings and at times will even attack man.

Their great numbers, universal distribution, and destructiveness combine to make brown rats the worst mammal pest known to mankind. Through their habit of living in sewers, among the offal of slaughterhouses, and in garbage heaps, from which they invade dwellings and storehouses, they pollute and spoil even more foodstuffs than they eat.

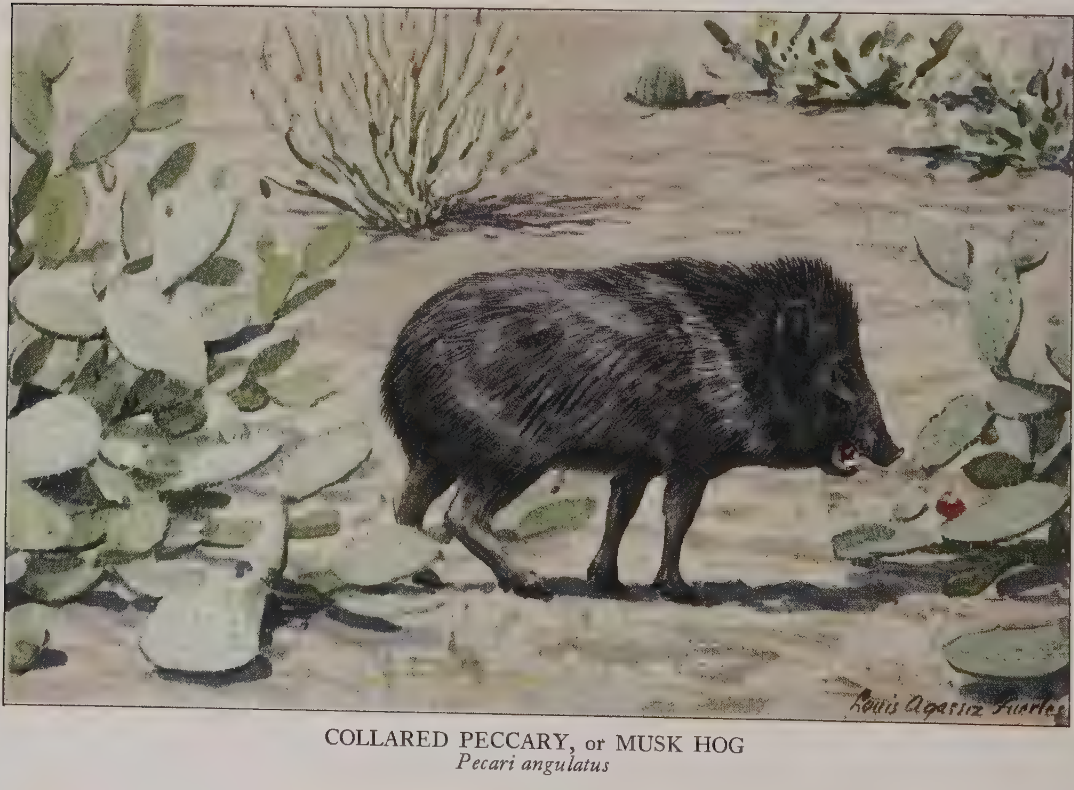


TRAIL OF THE COMMON BROWN RAT

The large series shows the ordinary foraging gait; the smaller series to the right shows the travel at low speed. In all, the tail mark is a strong feature.



MARSH RABBIT
Sylvilagus palustris


Louis Agassiz Fuertes

COLLARED PECCARY, or MUSK HOG
Pecari angulatus

In addition, they are known carriers of some of the worst and most dreaded diseases, as bubonic plague, trichinosis, and septic pneumonia; while there is little doubt that they spread scarlet fever, typhoid, diphtheria, and other contagious maladies. Bubonic plague is mainly dependent upon rats for its dissemination and has been carried by them to more than 50 countries, including the United States. In India more than 2,000,000 people have died in one year from this rat-conveyed disease.

Although rats are abhorred by man, yet they have been for ages so closely associated with most of his activities that they have long had their place in Old World literature. Among other instances, many readers will recall Victor Hugo's gruesome account of Jean Valjean's fight with the rats in the sewers of Paris. In England and on the Continent rat catching has been a regular trade and dogs have been specially bred for use in their pursuit.

Rats are loathsome vermin which civilized man should eliminate with the other evils of the semibarbaric days which he is leaving behind. One might still wish that in many places a modern "Pied Piper of Hamelin" would appear and rid the people of these pests. This is not necessary, however, if the public will cease to take their presence as a matter of course. Their exclusion from buildings and their destruction are merely matters of good housekeeping, both personal and communal.

Rats can be banished by removing or destroying trash heaps and similar harboring places and by the simple expedient of rat-proofing buildings, especially dwellings, granaries, warehouses, and other places where food supplies are stored.

These precautionary measures should be supplemented by trapping or poisoning in open places. Campaigns of this kind can be fully successful only when engaged in by the community at large. The returns from the investment for such a purpose will be large, not only in the vast money values of property saved, but in the reduction of the death rate and in the great improvement of the public health.

HOUSE MOUSE: Mus musculus

(*For illustration, see Color Plate, page* 172)

The familiar house mouse is of Old World origin and may be distinguished from most of our native mice by its proportionately slenderer body, long hairless tail, and the nearly uniform color on the upper and under parts of the body. Like the house rat, wandering an alien from its original home in Asia, and transported by ship and by inland commerce, it has gained permanent foothold and thrives in lands of the most diverse climatic conditions, except those of the frigid Polar regions.

For centuries the house mouse has been parasitic about the habitations of man, and in many places in America has spread into the surrounding country, where it holds its own in the struggle for existence with many of our native species. It is probable that its ability to live in houses also infested by the fierce brown rat is due wholly to its agility, and to the small size which enables it to retreat through crevices too small for the rat.

In buildings it hides its warm nests in obscure nooks and crannies, making them of scraps of wool, cotton, or other soft fibrous material, often cut from fabrics. Out in the field, like any other hardy vagabond, it adapts itself to whatever cover may be available on the surface or in crevices and the deserted burrows of other mammals.

It has several litters of from four to nine young each year. The young are born blind, naked, and helpless, but are soon able to run about, often following the mother on her foraging expeditions. When a little more than half grown, they usually scatter from the home nest and seek locations of their own.

Throughout most of its world-wide range, the house mouse has the same general appearance, but in some localities the effect of changed environment is developing appreciable differences which appear destined to result in marked geographic races. The representatives of these mice which I caught in weedy fields on the coast of Chiapas, near the border of Guatemala, have an appreciable rusty shade on the back in place of the ordinary dull gray.

The success of both the house mouse and the house rat in establishing themselves in all parts of the world, despite the antagonism of mankind, affords marvelous examples of physical and mental adaptability not equaled elsewhere among mammals.

From early days the domestic mouse has been a familiar member of the household with people of all degree, and the housewife has had to match her wits against the cunning persistence of this small marauder in order to safeguard the family supplies of food and clothing.

Although its destructive habits excite antagonism, the mouse is so small and often so amusing in its ways that it has commonly been regarded with a half hostile, half friendly interest. This is apparent by frequent references to it in proverbs, nursery rhymes, fables, and folklore, as well as in more serious literature.

Many cases of singing house mice have been recorded, their notes being a series of continuous musical chirps, trills, and warblings, rising and falling about an octave and slightly resembling the song of a canary. It has been claimed that this singing is due to an affection of the songster's breathing organs, but this can scarcely account for its being uttered at definite times and places and ceasing at the volition of the performer.

In one instance the song had been heard in a china closet and an observer sat by the open door to locate the singer. After patient waiting, "a mouse peered out from behind the plates, climbed up a little way on the brackets, and after looking around several times, began to sing." This mouse continued to sing in the same place at intervals for several weeks and became accustomed to the presence of people during its performances. Then it suddenly disappeared, probably a victim to one of the dangers which constantly beset its kind.

POINT REYES MOUNTAIN BEAVER: **Aplodontia rufa phæa** and its relatives

(*For illustration, see Color Plate, page* 174)

The first adventurous fur traders who penetrated the Oregon wilds found the Chinook Indians provided with robes made of skins of the mountain beaver. From that time until recently, but little accurate information has been available concerning the habits of this curious animal. Locally, it is known by several other names, including "sewellel," "mountain boomer," "boomer," and, in the Olympic Mountains, "chehalis."

The genus of mountain beavers contains only a single species with several subspecies, all having a close superficial likeness in size and form to a tailless muskrat, except for their coarse, harsh fur. It is an exclusively North American type and, aside from a remote relationship to the squirrel family, has no kin among living mammals. It appears to be a sole survivor from some former age. As with the pocket gophers, its mode of life has developed powerful muscles about the head, front legs, and forepart of the body.

The distribution of the mountain beaver in Tertiary times extended through the Great Basin to North Dakota, but at present it is closely restricted to the humid region between the crests of the Cascades and the Sierra Nevadas and the Pacific coast, and from the lower Fraser River, British Columbia, south to the latitude of San Francisco Bay, California.

Within this superbly forested region, this animal delights in locations that are cool and oozing with water, where, under the dense shade of an almost tropical undergrowth of shrubs, ferns, and other herbage, it constructs numberless tunnels and trails. These are sometimes in flats, but much more often along canyons and mountain slopes, among willow, alder, aspen, or other thickets, or even in the heavy coniferous forest.

Veritable colonies inhabit certain areas and the ground is honeycombed with burrows six to eight inches in diameter and covered with a network of surface trails. The irregular branching tunnels are sometimes two or three hundred feet in length and have at frequent intervals side passages through which the earth mined in extending the burrow may be ejected in small dumps. The tunnels appear in a large measure built for the safety of the owner in traveling, since they repeatedly come to the surface at the end of a log, where an open, neatly kept trail extends under its shelter the entire length, the tunnel being resumed at the far end of the log.

All surface runways connecting tunnel entrances or leading through the thick surface vegetation are well kept and free of all obstructions. The ground in these haunts is commonly so saturated with water that the tunnels form drainage channels down which run little streams.

Nest chambers discovered by T. H. Scheffer in the Olympic Mountains were located in tunnels two feet underground. They were oval in form and one measured 18 inches in horizontal diameter and 17 in height. Here three storage chambers opened directly from the nest chamber, one of which contained two quarts or more of sections of fern roots, which had been kept so long that they were spoiled, and another was partly filled with freshly cut leaves of nettles and twigs of cedar and fir. At the far end an opening dropped six inches into a small drainage basin partly filled with water, out of which led two passages. The roofs of the chambers were lined with a thin layer of clay, which appeared to have been packed in place by the owner.

In the upper and drier part of the nest, which was made of dried fronds of ferns, grasses, and small twigs, were found three young less than a week old, with coats of fine fur, but with eyes still closed. Like burrowing animals generally, the mountain beaver is cleanly in its housekeeping, and offal, loose dirt, and débris of all kinds are pushed out by the forefoot and head to the dumps at the less-used openings.

Although mainly nocturnal, the animals are active early in the morning and late in the afternoon, as well as throughout dark days. Those kept in captivity show periods of restless activity at night and alternating periods of sleep and wakefulness during the day. Sometimes they sleep coiled with the head turned under the body and again flat on their backs. During these periods their sleep is often so profound that they may be handled without being awakened.

One captive animal is reported to have uttered a curious quavering note resembling that of a screech owl. They have a strong musky odor, which is very evident when they are first caught, and which is frequently apparent about the burrows.

Careful and repeated efforts to keep these animals in captivity under as nearly normal conditions as possible in regard to food and surroundings in the vicinity where they were captured have, up to the present time, proved unsuccessful. In every case the animals failed to thrive and soon died.

The mating occurs about the middle of March, and a month later litters of two or three young are born. The young grow slowly, not attaining full size for a year or more, and do not breed until the second year, but they leave the shelter of the home nest and scatter to occupy burrows of their own at the end of the first two or three months.

The mountain beaver feeds upon nearly all small vegetation growing in its haunts, including, in addition to small herbage, shrubs, the bark of trees and bushes, ferns, and fern roots. More than 30 species of native plants have been found among its "hay" piles at the mouths of burrows. Since its country has become increasingly occupied by farmers it has developed a fondness for cultivated crops that, in many places, is rendering it a pest. It appears to have a special taste for cabbage, potato, and onion tops, and other garden produce.

When gathering its food it sits up, squirrel-like, and grasps the plant stem with one hand, a long projecting tubercle on the "heel" of the hand opposing the fingers like a thumb and giving a good grasp, so that it can pull plants down to be bitten off with the sharp front teeth.

Sometimes it climbs up a few feet into a bush or small branching tree after succulent shoots.

The mountain beaver has the interesting habit of gathering stores of green plant food, much like that of the cony on the mountain tops. But it appears to be more methodical in its ways, gathering the stems of such plants as grasses, ferns, and lupines, as well as twigs of various bushes, and carrying them in bundles as large as can be held in the mouth, the butts of the stems neatly laid together. These little bundles of "hay" are placed side by side about the entrances of the burrows, with the butts all parallel on sticks or other support to keep them as clear as possible of the ground. They are left thus for a day or more to cure before being carried into the subterranean storerooms.

Chief among the four-footed enemies of the mountain beaver are the fisher and bobcat, and an eagle has been seen keeping close watch at the entrance of their burrows.

In winter much of the mountain beaver country is buried under several feet of snow, but this does not stop the hardy animal's activities. Between the entrances to its burrows and out along the surface of the ground, it tunnels through the snow in various directions in search of forage.

At this time it cuts twigs from bushes and gnaws the bark from the trunks and roots of the smaller trees, sometimes completely girdling and killing trees more than two feet in diameter. Its underground tunnels are also extended at this season, the dirt being pushed up in dumps under the snow. Parts of the snow tunnels are packed so full of it for some distance that, when the snow disappears, the curious earth-forms, like those of the pocket gopher, remain.

The mountain beaver lives a monotonous existence and correspondingly lacks the mental vivacity of many other species which have a greater freedom of movement. When one is caught, it shows little fear, but struggles to escape, growling, clattering its teeth, and biting viciously at anything within reach. Its desire for food, however, appears to control its emotions, and very soon after being captured it will eat any green vegetation offered, as unconcernedly as though free.

That the mountain beaver possesses social instincts is evident, as a pair is often found occupying one set of tunnels, and in many favorable places a number will have their burrows closely grouped and connected with a network of communicating surface trails.

COMMON JUMPING MOUSE: Zapus hudsonius and its relatives

(For illustration, see Color Plate, page 174)

In several ways the common jumping mouse is unique among American mammals. Its strongest characteristics are a dull, rusty-yellowish color, a slender body about three inches long, a remarkably slender tail about five inches in length, and long hind legs and feet, which are specially developed for jumping, like those of a little kangaroo. In addition, it is provided with cheek pouches, one on each side of the mouth, in which it gathers food to be carried to its hidden stores.

The long tail serves as a balance during its extraordinary leaps, some of which in a single bound cover a distance of about ten feet. If by accident one of these animals loses its tail, whenever it jumps it is thrown into a series of somersaults, turning over and over helplessly in the air.

The jumping mice form a small group of species and geographic races closely similar in general appearance. They are the sole representatives in North America of the Old World jerboas and are themselves represented elsewhere by a single species occurring in the interior of China. The jerboa family contains, in addition, many larger and curiously diverse species distributed over a large part of Asia, Africa, and southern Europe. Many Old World jerboas are desert animals, some of them exact reproductions in shape and color of the kangaroo rats of arid regions in the Western and Southwestern States and Mexico, although they are in no way related to those animals.

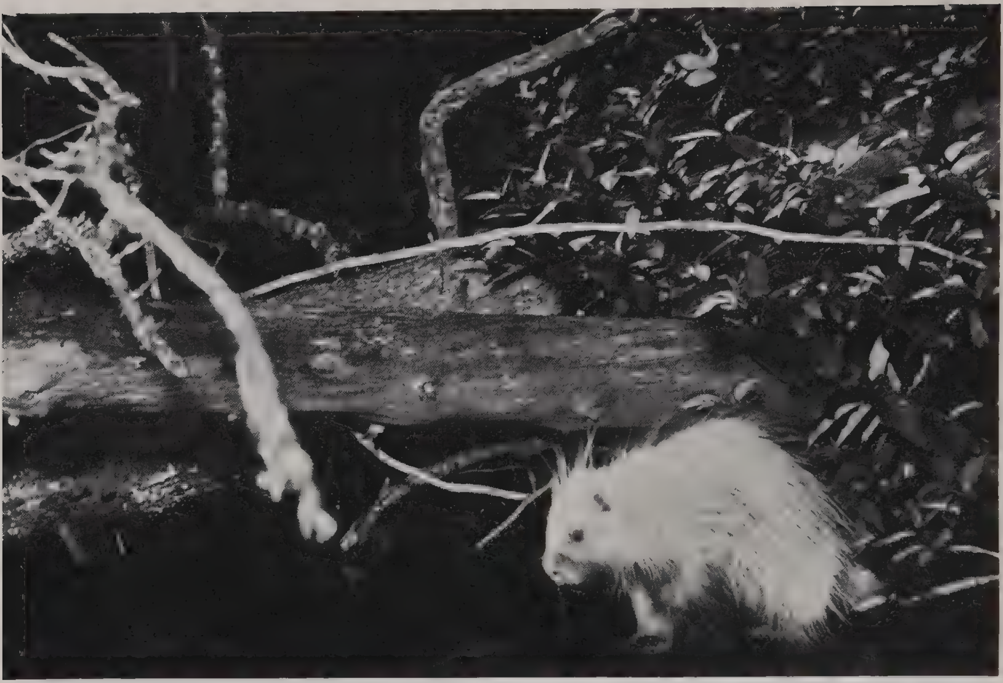
Jumping mice are distributed over most of the northern parts of North America from the Atlantic coast of Labrador to the Bering Sea coast of Alaska, and southward to North Carolina, Illinois, New Mexico, and California. They are nocturnal in habits and live in or near the borders of forests, in thickets of weeds or brushwood, and in meadows adjoining woodland areas or forest lakes. In prairie country they occupy belts of woody growth bordering streams. In congenial locations they range from sea level up to an altitude of 8,000 feet or more.

For winter homes they dig burrows two or three feet deep, in the lower parts of which they excavate oval chambers and fill them with fine grass and other soft material to make a warm nest. Other chambers opening from these burrows serve as storerooms for berries, seeds, and nuts of various kinds, among which beechnuts are a favorite.

The nests occupied as summer homes are placed in shallow burrows a few inches below the surface of the ground, or they may be in a hollow tree, under a piece of bark, in a dense tussock of grass, or in other makeshift shelter. In these nests the young, from two to eight in number, are born at varying times between May and September, indicating the probability that more than one litter is produced each season.

When suddenly startled from her nest, the female often flees with several of the young clinging to her teats. She runs swiftly through the grass, and if hard pressed will take a long leap, still carrying the pendent young. It is surprising that such delicately formed animals can make long leaps in thickly grown places and apparently land safely, especially when carrying their young. In the flights of the mother, some of the young must be jarred loose, but when the alarm is over no doubt she returns to find and rescue any that may be missing.

In the Northeastern States, jumping mice are common inhabitants of meadows. They are equally at home in the rocky meadows of New England, on the flower-spangled borders of rushing trout streams in the Sierra Nevadas of



Photograph by George Shiras, 3d

AN ALBINO PORCUPINE IN SEARCH OF FOOD AT NIGHT: FLASHLIGHT PHOTOGRAPH TAKEN IN NORTHERN MICHIGAN

For a number of successive years this animal occupied a very restricted area where it was studied and photographed many times by Mr. Shiras.

California, and the boggy glades of subarctic Alaska.

My first acquaintance with them was made many years ago, during haying time, in northern New York. Hidden under a haycock, as the last forkful was raised one of them was often revealed, and its startling leaps always resulted in an exciting chase, which usually ended in the escape of the strange little beast.

Unlike most of their small fellows of meadow and thicket, jumping mice regularly hibernate, occupying the nests near the bottoms of the winter burrows. They usually become fat on the abundance of food at the end of summer, and in September or October, with the approach of cool weather, enter their winter quarters and sink into the long, hibernating lethargy. Sometimes two of them hibernate in the same nest.

During hibernation they are coiled up in little furry balls, the nose resting on the abdomen, the hind feet on each side of the head, and the tail wound around the body. The winter sleep usually lasts until spring, but may be broken at any time by mild weather.

When hibernating, the mice appear cold and lifeless, but if one is carried into a warm house or even held a long time in the captor's hands, it will slowly awaken and may become as lively as in summer. When returned to a low temperature, however, it soon resumes its mysterious seasonal sleep.

CANADIAN PORCUPINE: Erethizon dorsatum and its relatives

(*For illustration, see Color Plate, page* 177)

The porcupine is one of the most grotesque of the smaller North American mammals. With a weight of from 15 to 20 pounds, its heavy body is supported on short legs, the feet resting flat on the ground like those of the raccoon, instead of on the toes, as in many small animals.

Its strongest peculiarity is the specialized development of most of the fur into rigid, sharp-pointed spines or "quills" from half an inch to more than three inches in length. That the spines represent the underfur of ordinary mammals is evident from the fact that they are overlain by long, coarse guard hairs, sometimes several times their length.

The spiny armament usually lies flat on the body, but when the animal is excited or alarmed it may be raised, by special muscles on the underside of the skin, into a bristling array of barbed points. The spines are so slightly attached that when their points enter the skin of an enemy, they at once become free at the base. When the points are firmly set in the skin of another animal, the spines can be withdrawn only with considerable effort, and if left will gradually work deeper and may traverse a considerable part of the victim's body before finally becoming encysted.

When assailed, the porcupine turns down its head, arches its back, and, on firmly planted feet with all its spines erected into a bristling cover, awaits the enemy. The instant its body is touched, the club-shaped tail, armed with a multitude of spines, is swung vigorously around and the animal so incautious as to receive the blow is pierced by a host of stinging darts which, freed from the porcupine, remain to torment the aggressor. This swift and effective sweep of the tail has probably given rise to the idea that the porcupine can "shoot" its quills when defending itself.

Despite its defensive powers, however, the porcupine is, on occasion, successfully attacked by various enemies, including the mountain lion, bobcat, fisher, and even the eagle and great horned owl. The fisher is said habitually to kill and feed upon them, and the encysted quills are commonly found under its skin.

The frightful effect of an ill-judged attack on a porcupine is shown by inexperienced dogs after their first encounter with this strange beast. That such an attack is a dangerous venture, even by the craftiest and most powerful of its enemies, is well demonstrated by occasional fatalities among large carnivores, which result from the great mass of spines imbedded in their heads and bodies.

The North American porcupine is a northern animal belonging mainly to coniferous forests, and ranges from sea level to timber-line. It originally occupied nearly all the forested parts of the continent south to West Virginia, southern Illinois, the Davis Mountains of western Texas, and the southern end of the Sierra Nevada in California, but was absent from the Southeastern States and the lower Mississippi Valley.

While characteristically woodland animals, at times they wander from forest shelters and have been found prowling above timber-line on high mountains, and among alder thickets beyond the limit of trees in the Far North. They are usually silent, but at times utter a curious squealing cry, and in addition have a variety of snuffing, growling, and chattering noises.

In the forests of tropical America, from Mexico to Brazil, other and shorter-quilled porcupines occur, characterized by smaller size and slenderer bodies with a long tail, the terminal half of which is naked and prehensile like that of an opossum. These animals inhabit forests where no conifers grow, and are much more arboreal in habits than their Northern relatives. Still other and even more strikingly different porcupines occur in Europe, Asia, and Africa, some of the African animals having heavy spines much more than 12 inches long.

All porcupines are true rodents, and the name "hedgehog" is erroneously used when applied to any of them. Hedgehogs are small Old World insect-eating mammals, which have their backs covered with porcupinelike spines, but are in no way related to the porcupines.

The American porcupines are mainly nocturnal, although they sometimes wander about by day. While largely arboreal in habits, they pass much of their time on the ground and commonly have their dens in caves at the bases of cliffs, under the shelter of large rocks, logs, piles of brush, or in hollows at the bases of trees. They are sluggish, stupid animals, with poor sight, and are unable to move rapidly, either in a tree or on the ground.

Although they are extremely deliberate on the ground, in the treetops they are even more sluggish and can be compared only with the sloth. As a result, they are practically helpless in the presence of an enemy except for the defense afforded by their spiny armor. That this is effective in most cases is evidenced by their continued presence throughout a large part of their original range where forests still exist.

Porcupines are solitary animals, totally devoid of any qualities of good fellowship with their kind, but the attraction of woodland camps often brings a number together. They are exceedingly fond of salt and persistently return to camps to gnaw logs, boards, or any other object having a salty flavor.

They appear to be practically omnivorous so far as vegetable matter is concerned and feed upon the bark and twigs of spruces, hemlocks, several species of pines, cottonwoods, alders, and other trees and bushes. In orchards and gardens near their haunts, they eat apples, turnips, and other fruits and vegetables and visit the shores of ponds for waterlily pads and other aquatic plants growing within reach.

Ordinarily they eat patches of bark from the tree trunks, but sometimes girdle the tree or at times denude the entire trunk. They often remain for weeks in the top of a single tree, even in the severest winter weather. I had a practical illustration of this on one occasion when storm-bound in a fur trader's cabin at the head of Norton Sound, on the north coast of Bering Sea, where a belt of spruces reached down from the interior. We were short of meat, and when one of the Eskimos reported that about two weeks before he had seen a porcupine in a spruce tree at a distance of several hours' travel on snowshoes he was sent to look for it. That evening he returned bringing the game, having found it in the very same tree where he had seen it many days before, although we had just experienced a period of severe weather, with temperatures well under 40 degrees Fahrenheit below zero. It was on this occasion that I first learned the palatable qualities of porcupine flesh.

Little is known definitely concerning the family life of these animals. The single young is amazingly large at birth and appears fully armed with spines. Long before it is half grown, it adopts the solitary habit of the adults and wanders forth to care for itself.

Porcupines have an intimate connection with the romantic side of early Indian life in eastern America. Their white quills were colored in bright hues by vegetable dyes known to the Indians and served to make beautiful embroidery on belts, moccasins, and other articles of aboriginal clothing until primitive art gave way to the more tawdry effects of trade goods.

CHAPTER XI

Conies, or Pikas, Hares, Cottontails, Marsh Rabbits, Brush Rabbits, and Other Rabbitlike Mammals

UNTIL a comparatively recent date the animals forming the Order *Lagomorpha* were considered as members of the Order of Rodents. Their structural differences are so marked, however, that they are now placed in an order by themselves. One of their outstanding differences from the rodents, and, as a matter of fact, from all other mammals, is their possession of a double set of upper incisors, the second set being like little pegs, immediately behind the normal pair, such as all rodents have. This order is world-wide in distribution except in Australasia and many islands. At least four genera are known in America.

The conies, or pikas, of the Family *Ochotonidæ* are mountain-loving animals, shaped like guinea pigs and further resembling them by the absence of a tail and the presence of short, rounded ears. Otherwise, their structure places them in the same order as the rabbits and hares. This family contains only the single Genus *Ochotona* and is peculiar to the Northern Hemisphere.

Members of this genus occur only in mountain ranges, usually near or above timber-line, where they frequent rock slides and other places where crevices among the rocks furnish their abiding places. They occur in southeastern Europe, in the mountains of northern Asia, and along the Rocky Mountains of North America. Numerous species occur in the Old World. In North America 24 species and subspecies have been described. These may all prove to be a single species with subspecies.

PYGMY RABBIT LIVES ON VOLCANIC SLOPES

The hares and rabbits of both the Old and New Worlds belong to the Family *Leporidæ*. The hares in both hemispheres belong to the same genus, but the rabbits in the Old World and America belong to very distinct genera. America has at least three genera of rabbits peculiar to it. The family is most abundantly represented in North America, where four genera with well above 100 species and subspecies are known. In South America they are much less numerous, for only one genus and a comparatively limited number of species and subspecies occur.

Hares and rabbits combined are more numerous in species, subspecies, and individuals in the United States than in any other equal area in the world.

The most remarkable American genus of this family is *Romerolagus,* which has a single species living only among dense growths of coarse grass on the slopes of the great volcanoes of Ixtaccihuatl and Popocatepetl on the southeastern border of the Valley of Mexico. It is a pygmy rabbit like an overgrown meadow mouse of the Genus *Microtus,* with its short, rounded ears, short legs, and long, grizzled body, but lacking any visible tail. It makes runways in the dense grass and has many of the habits of meadow mice on a well-drained slope.

The hares, Genus *Lepus,* are all characterized by the development of their hind legs for jumping, enabling some of these animals to attain extraordinary speed, and by long, broad ears, which combine to give them a distinctive appearance. They occur mainly in the Northern Hemisphere, Europe, Asia, and North America. Numerous species are known, those occupying the more northern areas or the slopes of high mountain ranges turning from the brown summer dress to snow white in winter. Some species occupy wooded haunts, but most of them belong to wide, treeless regions.

In North America we have about 45 species and subspecies ranging from extreme northern lands in the Arctic south to the Isthmus of Tehuantepec, Mexico. The jack rabbits of the western United States are the most widely known species in America.

NEW WORLD AND OLD WORLD RABBITS DIFFER GREATLY

Cottontail and other American rabbits, forming the Genus *Sylvilagus,* are very different from the European rabbit to which the name was first applied. The latter belongs to a different genus, with no native representative in America. All of the small American animals to which the term "rabbit" is applied, except the hares, already described, are entirely American, having no representatives in the Old World. The cottontail, marsh, and wood rabbits belonging to this genus range from coast to coast and from southern Canada to Patagonia.

In continental North America the genus contains about 55 known species and subspecies varying considerably in form and habits.

PIKA, OR CONY: Ochotona princeps
and its relatives

(*For illustration, see Color Plate, page* 177)

The pika, little chief hare, or cony, as it is variously named, is among the most attractive and interesting of our mountain animals. It is about the size and shape of a small guinea pig, with a short, blunt head, broad, rounded ears, short legs, practically no tail, and a long, fluffy coat of fur. While most nearly related to the hares and rabbits, it has very different habits.

The pikas form a group comprising many species, much alike in general appearance and distributed among the high mountains, from the Urals of Russia through Asia and northern North America. In Asia they occur mainly in the mountains through the middle of the continent south to the Himalayas. In Pleistocene time they ranged across Europe to England. In North America they are limited to the western side of the continent, from the Mount McKinley region of Alaska down the Rocky Mountains to New Mexico and along the Cascades and Sierra Nevadas to the Mount Whitney region, in California.

Giving to these North American animals the appellation "cony" is one of many instances in which the name of an Old World animal is brought to America to designate a totally unrelated species. Once fixed in current use, the misapplied term is certain to persist.

Pikas are among the few mammals which live permanently along the high crests of the mountains, mainly above timber-line, but they also descend in rock slides among the upper spruces, firs, and pines. The altitude of their haunts varies with the latitude, being between 8,000 and 13,500 feet in the United States, but in Alaska much lower.

In these cool, alpine regions the little animals live wholly within the shelter of rock slides and among the crevices of shattered rock masses. Their distribution is unaccountably broken, and although abundant in many places, they are absent from many others equally suitable. Their homes are in the midst of the flower-bedecked glacial valleys and basins, the haunts of the big marmots and mountain sheep.

They are mainly diurnal in habits, and throughout the day may be heard their odd little barking, or bleating note, like the syllables "eh-eh" repeated at intervals in a nasal tone, resembling the sound made by squeezing a toy dog.

Occasionally they may be heard barking at night, perhaps when disturbed by some prowling enemy. Their notes have a curiously ventriloquial quality, which renders it difficult to locate the animals uttering them.

Owing to their dull gray or brownish colors, the pikas blend with their background so completely that when quietly sitting on a rock they are extremely difficult to see. Even when running about at a little distance they are not easily noted. Their movements are quick and they scamper over the rough surface of a rock slide with surprising agility.

Little is known of their more intimate life history. Their young, three or four in number, are born usually during the first half of summer and are out foraging when less than half grown.

Small bright eyes and big, rounded ears give pikas an odd and attractive appearance, unlike that of any other mountain animal. They are extremely watchful and at the first alarm disappear in the shelter of their rocky fortresses. Their little bark, however, continues to come up from their hiding places with constant iteration. If the observer will sit quietly at some good vantage point his patience will eventually be rewarded by the appearance of the pika on the top of a stone near the mouth of its retreat.

After a time, if everything is quiet, it resumes its scampering about over the rocks or may come to the border of the slide and make little excursions across the open ground after some of its forage plants. Skipping nimbly from the border of the slides to neighboring patches of vegetation, sometimes 50 or more feet away, the pika nips off the stems of short grasses or other plants and, taking up little bundles of them crosswise in its mouth, runs back to add them to its "stacks." These sallies are quick little runs, made as though in fear of being long away from the safety of the rocks. Caution is needful, however, in a world where lurk such enemies as coyotes, lynxes, foxes, weasels, hawks, and owls.

During late summer the pikas have the extraordinary habit of gathering stores of small herbage in piles containing sometimes a bushel each, usually well sheltered in dry places under the rocks where they live. Pikas are active all winter, and these little stacks of well-cured hay, containing a great variety of small plants, serve them as food during the severe cold season, when at these high altitudes they are buried under many feet of snow.

In pleasant weather, near the end of summer, visitors to the mountains of Colorado, Glacier National Park, the high slopes of Mount Shasta, or the Sierra Nevadas may have the pleasure of watching the pikas hard at work doing their "haying." One of their "stacks" in the mountains of New Mexico contained 34 kinds of plants, including many flowers. No one who once becomes acquainted with these unique and gentle little animals will ever cease to remember them with friendly interest.

ARCTIC HARE: **Lepus arcticus** and its relatives

(*For illustration, see Color Plate, page* 181)

Many parts of the northernmost circumpolar lands are occupied by hares, which attain a weight of more than ten pounds. They are about the size of large jack rabbits, but are more heavily proportioned, with much shorter ears and shorter, stronger legs. There are several species and geographic races of these animals, all of which are snowy white in winter except for a small black tip on each ear. In summer the southern Arctic hares change to a nearly uniform dull iron-gray or grayish-brown. The animals of Ellesmere Island and Greenland, where the summer is brief and severe Arctic conditions prevail, retain their white coat throughout the year.

In keeping with the cold climate of their territory, the furry coat of the Arctic hares is long and thick, especially in winter, when the ears, legs, and even the soles of the feet, as well as the body, are heavily furred. The coats of the hares of north Greenland and adjacent regions are so heavy and fleecelike that during the spring molt they come off in felted patches as the new coat is assumed, giving the animals a curiously ragged appearance.

In the region between the areas in which the summer coat remains wholly white and where it is completely changed to grayish, there is a gradual transition, with the lessening severity of the climate, through every intermediate degree between the two. As in the case of the snowshoe rabbit, the large hind feet and long spreading toes of its big northern relative are so heavily covered with hair that they form broad fluffy pads, which enable the hares to travel lightly over the Arctic snowfields.

The distribution of Arctic hares is confined to the barrens or tundras beyond the limit of trees. They range practically to the land's end of northern Greenland and Ellesmere Island. To the southward in North America they range down the coast of Labrador and across to Newfoundland, where they are limited to the open barrens. They also occur along the shores of Hudson Bay and follow the tundras bordering Bering Sea to the Peninsula of Alaska.

In Ellesmere Island they are reported to be extraordinarily numerous at times in certain little valleys, and the fur traders on the coast south of the Yukon Delta informed me of similar gatherings in spring on gently sloping hillsides in that region. Photographs taken in Ellesmere Island show many of these hares scattered over a small area, each crouched in a compact form and all heading in the same direction to face the wind. Such gatherings, at least those in Alaska, occur during the mating period, after which the animals scatter over the area they occupy.

An account of the big northern hares would be incomplete without reference to the white-tailed jack rabbit, the largest of all American hares and a near relative of the Arctic species. It attains a weight of 12 pounds or more and appears like a giant of its kind. It has longer legs than the Arctic hare and a longer tail. In summer it is grayish or buffy, with a conspicuous pure-white tail. Throughout most of its range in winter it becomes pure white except the black tips to the ears, but near the southern border the change to white is not so complete as in the North. The distribution of the white-tailed jack rabbit extends from Minnesota to the Cascade Mountains and from the Saskatchewan River, in Alberta, south to southern Colorado.

Arctic hares have from one to seven young in a litter each spring. The climatic conditions under which they exist are such that it is doubtful if more than a single litter is born each year.

The manner in which animal life adapts itself to its environment is beautifully illustrated by the Arctic hares of north Greenland and Ellesmere Island. There the conditions are rigorously Arctic and continuous winter night extends through a period of several months. In all this region the scanty and dwarfed vegetation is covered with snow and ice the larger part of the year. The hares living there are a geographic race of those living farther south, but have developed into larger and stronger animals, with heavier fur, to meet the sterner conditions of life.

Their claws are much larger and heavier, so that they may dig the snow from the hidden herbage. Most marvelous of all, the anterior ends of both jaws are lengthened and the incisors set so that they project and meet at an acute angle, thus serving, tweezerlike, more readily to pick out the lowly vegetation imbedded in the snow.

In most parts of their range Arctic hares are scarce and rarely encountered. Each winter during my residence on the coast of Bering Sea the Eskimos killed only a few individuals. They were shy and watchful and the hunters sometimes followed one on snowshoes all day over the tundra without securing it. In the high North they appear to be more numerous in places, judging from the number killed for food by members of polar expeditions. Their flesh is excellent, but a little dry. Their natural enemies include wolves, foxes, weasels, gyrfalcons, and snowy owls, all of which share their desolate haunts and join in destroying them.

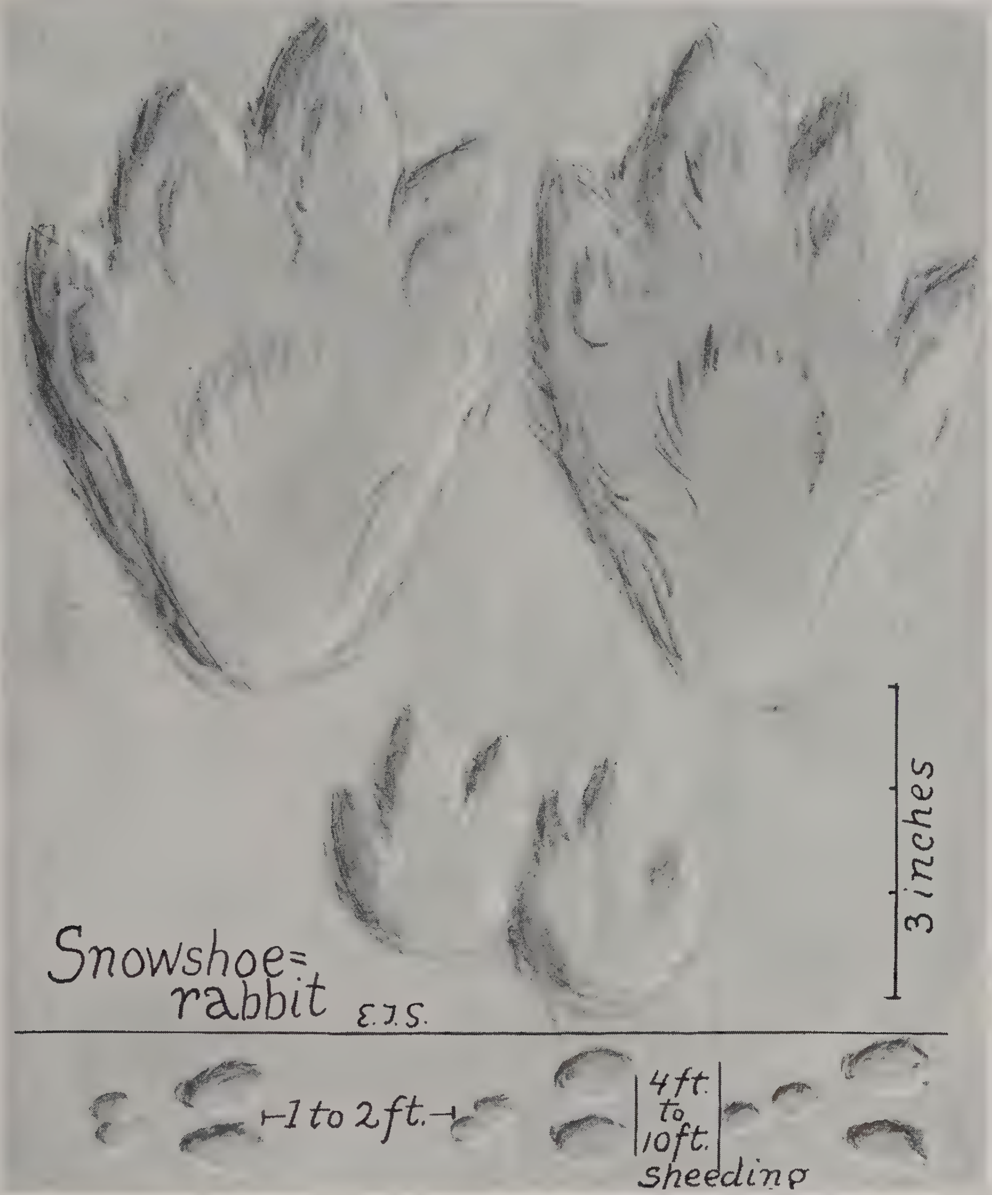
The winter skins of Arctic hares have a beautiful snowy white pelage, which makes warm garments and sleeping robes for the North, but are too delicate to withstand much service.

VARYING HARE, OR SNOWSHOE RABBIT: **Lepus americanus** and its relatives

(*For illustration, see Color Plate, page* 181)

The varying hares, white rabbits, or snowshoe rabbits, as they are known, form a small group of closely related species and geographic races of hares peculiar to northern North America. They sometimes attain a weight of five pounds and are about half the size of the Arctic hares, which they resemble in form, except that they are more heavily built and have proportionately shorter legs and larger hind feet.

With a single exception they become white in winter and change to dusky or brownish in sum-



FOOTPRINTS OF THE VARYING HARE, OR SNOWSHOE RABBIT

The great size of the feet, from which the creature is named, is a strong feature of the track, distinguishing it from that of the cottontail and others (see pages 196 and 199).

mer. The molt from the brown summer coat to the white winter one occurs with the arrival of winter snows, the exact time varying according to the season, the reverse change in spring being governed in a similar way by the disappearance of the snow. In the southern part of their range the change to the white winter coat is less complete than in the North. There has been much controversy over the manner of this change in color, some maintaining that on the approach of winter the hairs turn white with the first snow. It has been definitely proved, however, that both seasonal changes are due to molt.

The Washington hare (*Lepus washingtoni*), which remains brown throughout the year, is the exception to the rule of white winter coats in this group of hares. It lives in the cool, dense forests of the humid coast belt of Washington and the adjacent part of British Columbia, where the snowfall does not affect its pelage.

Photograph by George Shiras, 3d

PUTTING ON THE ROOF

A beaver coats the top of his house with mud. A flashlight picture taken in northern Michigan. The fur of beavers in this region is among the darkest and most valuable of its kind.

In winter the large hind feet of the varying hares and their long, spreading toes are entirely covered with a heavy coat of hair, forming broad snowshoelike pads which enable their possessors to move about freely over the soft snow, a peculiarity that has given rise to one of the names in common use.

In cool, forested regions varying hares range from Maine and extreme eastern Canada, including Newfoundland, to the Pacific coast, and from the stunted bushes bordering the northern limit of trees south to the northern border of the United States and beyond, following the higher Alleghenies to West Virginia, the Rocky Mountains to New Mexico, and well down the Sierra Nevada in California.

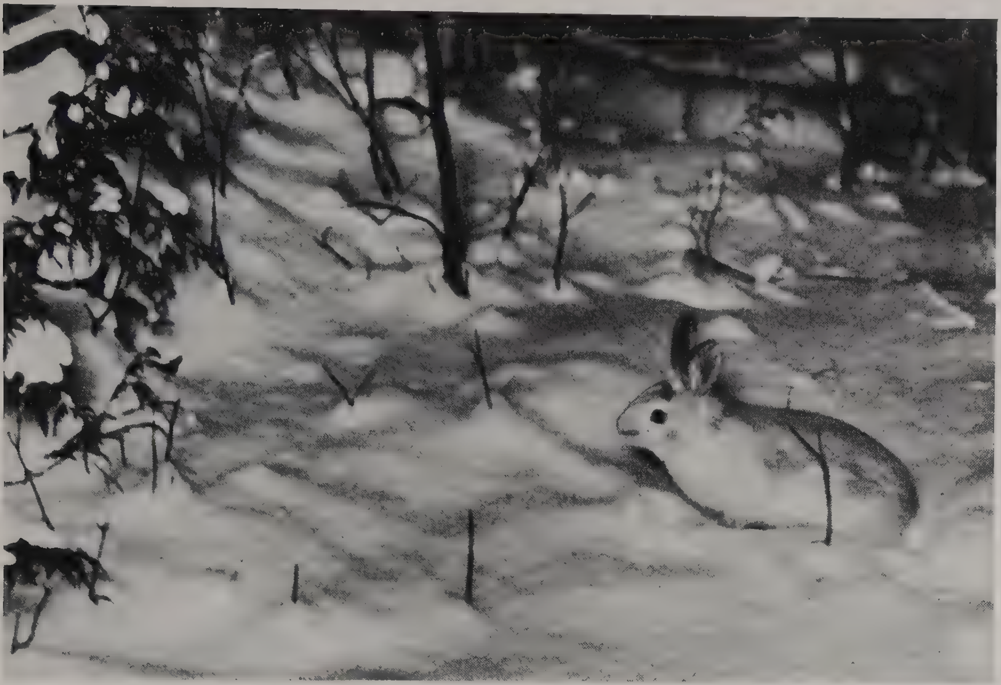
As in the case of other species, these hares make "forms" in which they lie by day, for they are mainly nocturnal in habits. The mating season occurs in early spring, when the males become very restless, several sometimes congregating in the same vicinity and occasionally fighting and chasing one another about. At this time, as well as at other seasons, snowshoe rabbits have a habit of thumping rapidly on the ground, making a dull sound audible for some distance. This is probably done with the hind feet, as is known to be the case with the European rabbit.

The thumping is apparently a signal and may be a part of the mating display, but it is also used for warning purposes. Hunters in northern Canada call these rabbits by making a harsh squeaking noise with their lips. Sometimes they become so eager and excited on hearing this call that with odd little grunting sounds they come bounding close up to the hunter.

The young, varying from two to seven, are born in nests made of dry leaves, grasses, and other suitable vegetation, warmly lined with hair from the mother's body, and usually hidden under brush or in dense vegetation. Since they have their eyes open and are fully furred at birth, within a few days they leave the nest and move freely about. Although the mother snowshoe rabbit will defend her young at first even at the risk of her life, when they are half grown she leaves them to shift for themselves. Young hares of various ages when caught often utter shrill squealing cries of fright and the older animals when wounded and caught sometimes do the same.

Perhaps through living so constantly on low ground, among swamps and along streams, varying hares become less averse to entering water than most of their kind. In the delta of the Yukon River I saw many places where they had crossed small streams in spring, their wet tracks entering and leaving the water, thus furnishing unmistakable evidence. Curiously enough, when caught by a flood they will take refuge on stumps or other support and often remain to starve rather than swim ashore.

In summer, owing to their nocturnal habits and the dense thickets they inhabit, varying hares are rarely seen unless they are unusually plentiful. In winter their presence is known by



Photograph by George Shiras, 3d

A VARYING HARE IN WINTER DRESS

Known also as snowshoe rabbit, this is a forest animal living from the northern United States north to the limit of trees. In summer it is brown, much like a cottontail, but with the coming of snow it changes by a molt to pure white, which it wears until spring.

their conspicuous tracks leading in every direction through their haunts. A single animal will in one night so thoroughly track the snow in a patch of woods as to give the impression that several must have been there.

In river bottoms, among densely wooded swamps, these rabbits frequently make definite beaten runways in the snow; runways are also made through thickets in their summer haunts. This habit renders it easy to snare them, and enormous numbers are thus captured every winter.

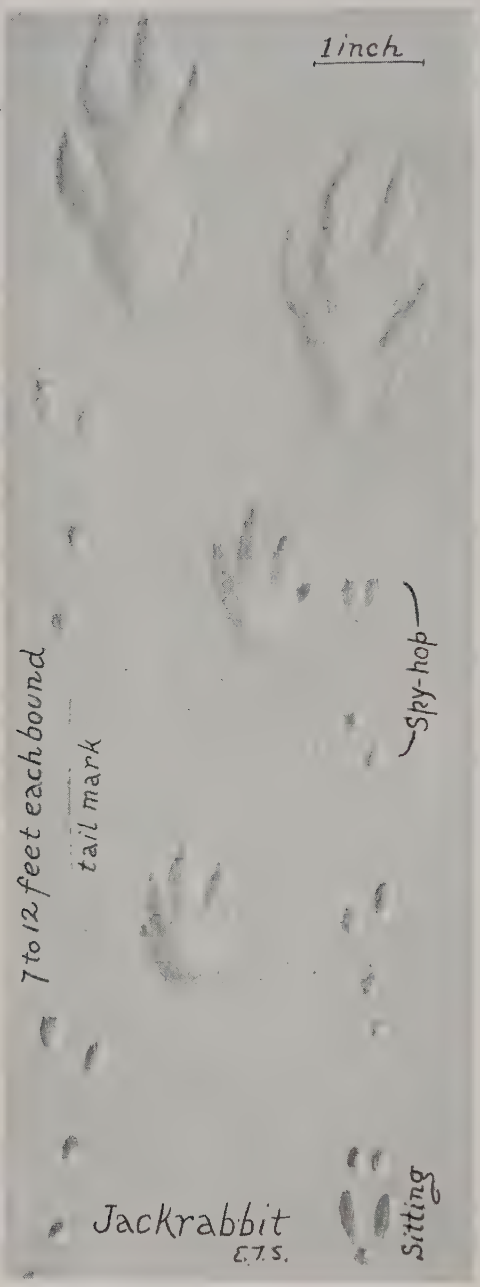
They feed on a variety of small herbage in summer and in winter depend on buds, twigs, and the bark of shrubs and small trees. They are specially fond of willows, and their winter distribution in many districts is governed by the abundance of willow thickets.

Varying hares are one of the most important mammals of the northern fur country. They are generally distributed and exist in such numbers that they are an important source of food supply both to the Indians and to such predatory birds and mammals as the great horned and snowy owls, the goshawk, gryfalcon, lynx, fox, ermine, fisher, and others. The skins are also used by the Indians for robes.

Under favorable conditions they steadily increase until they become enormously plentiful over great areas. After this swarming abundance continues for several seasons it reaches a maximum, and then, as in the case of many other mammals when similarly overabundant, a mysterious malady suddenly attacks and sweeps them off, until within a year or two they become rare over the entire area. The people of the fur country believe these changes in numbers run in cycles of about seven years each.

As the hares increase in numbers some of the birds and mammals which prey upon them increase proportionately. This is specially marked with the big northern lynxes. The skins of varying hares are gathered and sent to the London fur market with other furs, including those of lynxes. In the records of sales of the Hudson's Bay Company there are direct increases of the numbers of Canada lynx skins sold corresponding with the increases in the sales of varying hare skins. As the number of hare skins abruptly decreases following the outbreak of epidemics among these animals, there are correspondingly abrupt decreases in the numbers of lynx skins sold.

This correlation is shown in the records extending back many years and illustrates the interdependence in Nature between the various forms of animal life. The far-reaching tragic effect of the sudden disappearance of the snowshoe rabbits is not confined to the wild inhabitants of the forest, as it has not infrequently brought starvation and death into many lonely Indian lodges in the great northern wilderness.



THE TRACKS OF THE JACK RABBIT

The tracks of the Western jack rabbit resemble those of the cottontail (see page 199), but the feet are seldom paired; a typical set is seen in the lower left corner. The bounds cover 10, 12, or even 15 feet each The tail is held down, so that it leaves a mark in the snow between each bound. Sometimes the animal makes a spy-hop—that is, a high, soaring leap, as if to command a better view (see text, page 198). This is seen in the track.

ANTELOPE JACK RABBIT: Lepus alleni and its relatives

(*For illustration, see Color Plate, page* 178)

The antelope, or Allen, jack rabbit is one of the most picturesque of American mammals. It is larger than the common Western jack rabbit and is strongly characterized by enormous ears, long, slender legs, short tail, and contrasting colors. It is a member of the white-sided group of jack rabbits, which are distinguished by the extension of the white of the underparts well up on the sides of the body.

This group is represented in limited areas on our southern border by two species. One of these, the Gailliard jack rabbit (*Lepus gailliardi*), occurs on the grassy plains of extreme southwestern New Mexico and is succeeded by other white-sided species southward across the Mexican table-land and through interior Oaxaca to the Pacific coast, on the Isthmus of Tehuantepec. The other species, the antelope jack rabbit, occupies a considerable area in southwestern Arizona, and with its geographic races ranges southward through the coastal plains of Sonora and Sinaloa to northern Tepic.

All jack rabbits are more or less closely related to the Old World hares, the term "rabbit" having been so generally misapplied to them by the early settlers in the western United States that the name is now fixed by current usage. In Mexico and among the Mexicans of our southwestern border the proper distinction is made and the jack rabbit is termed *liebre,* or hare, and cottontail is called *conejo,* or rabbit.

The white-sided species are more widely differentiated from their Old World relatives than the other jack rabbits and are the southernmost representatives of the true hares in America, reaching their limit in the Tropics a little beyond the Isthmus of Tehuantepec.

The extension of the white on the sides of these species assists in producing one of the most extraordinary examples of directive coloration known among mammals. I had the pleasure of discovering this one day in May, 1895, when hunting on horseback over the grassy plain bordering the Pacific coast of the Isthmus of Tehuantepec. As I rode slowly along, a big jack rabbit hopped deliberately from its form in the grass a few yards away. Then, by the contraction of a special set of muscles along the back, it drew the dark-colored dorsal area forward and together so that it formed only a narrow band on the middle of the back, with a corresponding extension of the white area on the rump and sides until, as the animal moved diagonally away, it looked almost entirely white.

At a distance of 50 or 60 yards it came to a stop, and expanded and contracted the dark dorsal area, thus producing a "flashing" effect with the changing area of white on the sides and rump. This solved the riddle of the mirror-like white flashes I had often seen as jack rabbits on the table-land had dashed away in the brilliant sunshine. The same habit of "flashing" the white was afterward observed in the species of southwestern New Mexico and southwestern Arizona, demonstrating the appropriateness of the name, "antelope jack rabbit," given them by the ranchmen.

Formerly the antelope jack rabbit of Arizona was common on the plains about Tucson, where many were shot for rifle practice. They are now comparatively scarce in that district, but never became so excessively abundant at times as did the common species of the West. They have an extraordinary appearance as, with their great ears erect, they stand poised on their long thin legs. When alarmed, they leap away with amazing celerity in long, high bounds. They are usually much more shy and alert than the common jack rabbits and at times are far more difficult to stalk than antelope. A peculiarly appropriate setting to this remarkable species is found in the strange and wonderful growth of giant cacti, yuccas, creosote bushes, fouquierias, paloverde, and other desert vegetation of the plains in Arizona and Sonora.

Like other hares, the antelope jack rabbits occupy forms under bushes or in the shelter of little patches of coarse vegetation. The only exception to this rule I have seen was west of the city of Guadalajara, on the Mexican tableland. There one summer day, in the midst of a lovely open valley covered with short, velvety green grass and dotted with scattered acacia bushes, a caracara eagle suddenly swooped down upon a young white-sided jack rabbit. In mortal terror the little beast dashed away at great speed, the caracara casting at it repeatedly from a height of 15 or 20 feet and each time striking the ground just behind. The young animal ran not less than five hundred yards, straight for a little bush on a small bank, where it vanished as by magic.

The caracara was close behind and, alighting, ran round and round the trunk of the bush, craning its neck and apparently as surprised as myself at this sudden disappearance. Riding over to investigate, I found, partly concealed by coarse grass, the entrance of a burrow large enough to admit an adult jack rabbit. It extended almost horizontally into the bank for about 18 inches, and then, turning abruptly to the left, ended in a rounded chamber some 15 inches in diameter, in which the young jack rabbit lay snugly ensconced. It appeared altogether probable that this burrow had been made by the old jack rabbit as a shelter for her young, one of which in its extreme need had again sought asylum there.

White-sided jack rabbits are frequently found in pairs, occupying forms in close proximity to one another. More rarely several may be found in a small area. When driven from the forms, they often run in a wide circle, and in the course of half an hour or more may be detected returning slyly and watchfully from a direction nearly opposite to that in which they departed.

CALIFORNIA JACK RABBIT: **Lepus californicus** and its subspecies

(*For illustration, see Color Plate, page* 182)

The common hares, or gray-sided "jack rabbits" of the Western States, are among our best known and most interesting mammals. They are characterized by long, thin necks, long ears tipped with black, long legs, grayish sides differing but little from the color of the back, and a rather long tail, black on its upper side and dingy gray below.

They are abundant and generally distributed over a vast and mainly treeless area in middle North America, extending from western Missouri and eastern Texas to the Pacific coast, and from the border of South Dakota and the Columbia River Valley of Washington south over the table-land of Mexico and throughout the peninsula of Lower California. Within this region they range from sea level up to an altitude of over 9,000 feet. In the North they experience severe winters with much snow, but never show any winter whitening of their furry coat, as do more northern hares.

The gray-sided hares over all this extended range belong to a single species, typified by the California jack rabbit. The area thus occupied includes many different climatic and other physical conditions, from the sweeping grassy plains of Kansas to the juniper- and pine-dotted plateaus of the Rocky Mountain region, the foggy coast of California, the hot cactus-grown deserts of the Southwest, and the cool elevations of the Mexican table-land.

This varying environment has worked on the plastic organization of the species and modified it into a considerable number of well-marked geographic races which together make up the gray-sided group of jack rabbits, in contrast with the white-sided group already described. Some of the races are very dissimilar in color, but each merges imperceptibly into its neighboring races, and the group thus forms an unbroken chain of subspecies.

Like other hares, the jack rabbits are both diurnal and nocturnal in habits. They do not burrow, but make forms among dense growths of grass or weeds, or under bushes, where they lie hidden. It is a question whether they have more than one litter a season, although it is known that in some parts of their range young are born at all times throughout the spring and summer. From one to six are produced at a time, fully clothed in fur and with their eyes open. Within a few days they leave the form and run about like little furry balls. Even at this early period they are amazingly alert and skillful in evading capture by quickly doubling and zigzagging when pursued.

Throughout its range the gray-sided jack rabbit is preyed upon by a host of enemies, including wolves, coyotes, wildcats, eagles, and several species of hawks and owls. As a result, it has become extremely cunning and watchful. It is a beautiful sight to observe the cautious grace with which one that suspects danger but thinks itself unobserved will quietly move out of its form, pause like a statue for a few seconds, then raise its body into a sitting posture and look keenly about, its great upstanding ears turning sensitively to one side and the other, delicately testing the air for sound waves which may spell approaching peril.

If not alarmed it may then move slowly along by a series of easy little hops, occasionally varied by the single-footed gait of most other mammals. At such times the ears are often raised and lowered as though worked by some mechanism. If the rabbit becomes alarmed, however, it leaps away in quick, springy and graceful bounds, now and then making a high, soaring leap as if to command a better view.

These occasional high leaps mark the first stages of alarm. In greater stress, when pursued by a coyote or other swift-footed enemy, the jack rabbit indulges in no such showy performances, but gets down to serious work. Developing marvelous action in a continuous series of rapid, low-stretching leaps, with ears lying flat along the shoulders, it skims over the ground almost as swiftly as a bird. Coursing jack rabbits with greyhounds was for many years a favorite sport in different parts of the West. No other dog has much chance for success in the open pursuit of these animals.

Ordinarily jack rabbits are mute, but when wounded and caught they not infrequently utter a series of long-drawn wailing shrieks which are movingly expressive of terror and pain.

Since the settlement of the Western States numberless predatory animals have been killed and at the same time the cultivation of the soil has produced a dependable increase in the food supply. These changes have resulted in the sporadic increase of jack rabbits in many parts of their range, from Texas to Oregon, until at times they have become a serious menace to agriculture.

During such periods of abundance they invade fields and devastate grain, forage crops, vineyards, and young orchards. In places they have sometimes actually destroyed entire crops and forced settlers to abandon their locations. In winter they swarm about haystacks and destroy many tons of hay. Depredations of this character were committed by them on a considerable scale during 1916 in parts of Oregon, Idaho, and Utah.

During the early development of the San Joaquin Valley, California, jack rabbits became such an intolerable pest that great community drives were organized. Large woven-wire corrals with wing fences leading away several miles from the entrance were built on the open plains. The occasions of the drives were made public holidays through all the surrounding region, and people gathered sometimes to the number of from 5,000 to 8,000. A great line of beaters was formed, miles in length, and the jack rabbits were driven between the wing fences into corrals. Four such drives in Fresno County in the spring of 1892 resulted in the destruction of 40,000 jack rabbits, one drive netting more than 20,000 animals.

At this time the level floor of the San Joaquin Valley was crossed by numberless well-worn rabbit trails six or eight inches broad and one or two inches deep, extending in long straight lines sometimes for miles. On approaching a patch of large weeds one often saw 20 or 30 jack rabbits dash out and, after hopping away a short distance, sit with upstanding ears to look curiously at the intruder.

It is a general rule that when any species of animal becomes extremely numerous it loses its ordinary wariness and, conversely, when its numbers are materially reduced its wariness is greatly increased. The periods of abundance of jack rabbits usually extend through several years until, at the height of their increase, a contagious malady suddenly sweeps them away almost to the point of extinction, as in the case of the varying hare. A period of years follows during which their numbers are slowly recovered.

Jack rabbits are specially adapted for life on great plains, where speed and the ability to subsist on almost any form of vegetation are prime qualities. They are as grotesquely characteristic of the Western States as the kangaroos were of Australia, and have entered largely into the literature of the region they occupy.

COTTONTAIL RABBIT: Sylvilagus floridanus and its relatives

(For illustration, see Color Plate, page 182)

The American cottontails and their near relatives, the brush rabbits and others, combine characteristics of both the hares and rabbits, but are most like the rabbits, of which they appear to form aberrant groups.

The cottontails are distinctly smaller than most of the American hares and average from two to three pounds in weight. They are otherwise contrasted with the hares by their short ears, proportionately shorter and smaller legs and feet, and by the fluffy snow-white underside of the tail, which shows so conspicuously as they run that it has given them their distinctive name.

The American mammals to which the term "rabbit" may be properly applied include not only the cottontails, but numerous other species closely similar in form and general appearance, but lacking the cottony white tail. As a group, these rabbits have a far greater distribution in America than the hares. They range from the Atlantic coast to the Pacific and from the southern border of Canada south through Central and South America to Argentina. Their vertical distribution extends from sea level to above timber-line, attaining an altitude of more than 14,000 feet on Mount Orizaba, Mexico.

In the United States cottontails are so numerous and generally distributed that they are well known to nearly everyone. They inhabit all kinds of country, from the deciduous forests of the Eastern States to the grassy or brush-grown plains and pine-clad mountain slopes of the West and the sun-scorched deserts of the Southwest. As a result of this extended distribution and the variety of conditions in the areas occupied, these rabbits include numerous species and geographic races, which in some instances differ greatly in appearance.

Cottontails are especially common about the brushy borders of cultivated lands throughout the country, and in fertile brush-grown areas of foothills, valleys, and river bottoms of the West. They are mainly nocturnal, and in areas where there is an abundance of natural cover in the way of brushy thickets and dense grass they commonly make concealed forms in which they lie safely hidden.

In areas where shelter is represented by scattered bushes and a comparatively thin growth of other vegetation they generally occupy burrows in the ground. These may be holes deserted by badgers or prairie dogs or dug by themselves under a rock or other object. Hollow logs or natural cavities and crevices among the rocks are also frequented. When pursued by dogs, hares as a rule rely solely on their speed for safety, while the cottontails take refuge in the first hole they can reach.

Everywhere in their territory, as the shades of night approach, the cottontails come forth from their hiding places and skip merrily about in open ground on the borders of thickets and similar shelter, where they search for the tender green vegetation on which they love to feed. After it becomes too dark to distinguish their forms, the white tail may be seen twinkling about in the dusk. During the night they are often revealed on country roads by the headlights of automobiles.

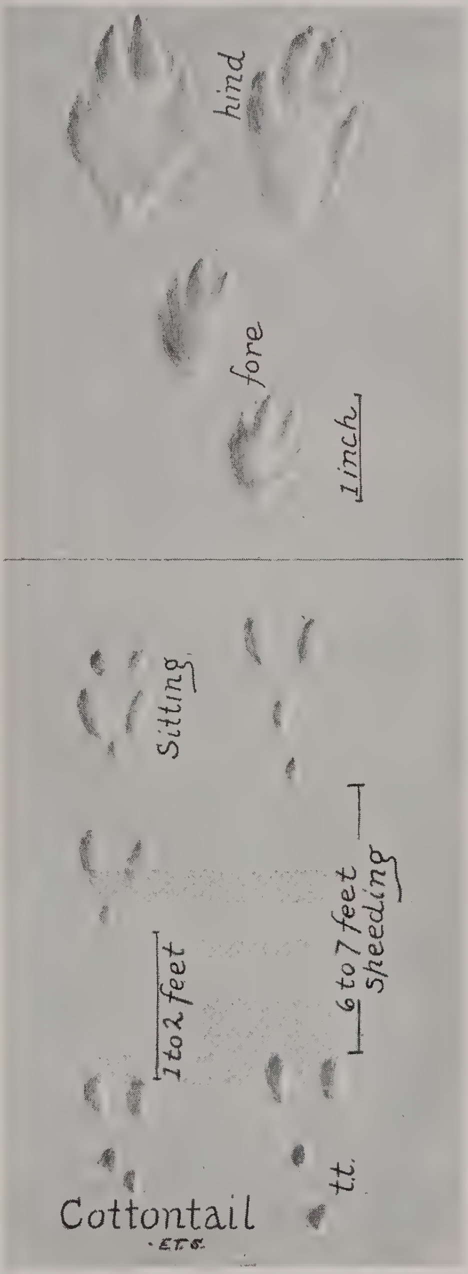
Several litters of from two to six young usually appear during the spring and summer. These are born blind and with extremely short hair, their almost unclad helplessness strongly contrasting with the open-eyed, fully furred, and alert young of the hares at the same age. This is a conclusive indication of the close relationship between cottontails and European rabbits, the young of the latter being similarly, but even more, undeveloped at birth.

The young of the cottontails are born in nests made of dead grasses warmly lined with fur from the mother's body. If above ground the nest is placed in a little depression and so artfully concealed by a covering of dead grasses that it can be discovered only by accident. When caught, young cottontails utter little cries of alarm; the wounded adults sometimes shriek in terror.

From the early settlement of the United States to the present day cottontails have been so abundant that they have served as a valuable source of our game food supply. They are hunted with guns and with dogs, as well as being snared and trapped. Enormous numbers, running into the millions, are killed in this country yearly, but they are so prolific that they hold their own in a surprising degree.

Their abundance in many places, however, has made them a serious pest to agriculture. They eat growing alfalfa and other forage plants, many kinds of cultivated vegetables, young grapevines, and nursery stock, and even kill orchard trees by gnawing the bark from the base of the trunks. As a result those who suffer from their depredations consider them pests to be destroyed, while others look upon them as desirable game animals to be protected by law.

As game animals the cottontails furnish some of the most delightful and interesting sport available to American hunters. The scurrying zigzag rush of a cottontail for the nearest shelter is so full of energetic motion that it always excites a pleasurable thrill in the observer, and even the keenest sportsman has so friendly a feeling for these little animals that the escape of one of them from an unsuccessful shot nearly always leaves a feeling of amused indulgence.



THE COTTONTAIL RABBIT'S TRACK

The large set of four tracks at the top gives the maximum possible of detail, which is rarely seen. The lower figure in the right corner is a typical track (*tt*). At the set labeled "sitting" the tail mark is seen, and in this only are the forefeet tracks ahead of the hind tracks. The cottontail has five toes on the front feet, but only four ever show in the track. These tracks are especially interesting when compared with those of the snowshoe rabbit on page 193 and the jack rabbit on page 196.

The cottontails have a secure place in American literature and folklore. Who has not read the wonder stories of the adventures of "Brer Rabbit" and ever after had a warmer feeling of fellowship for his kind? The presence of cottontails is a source of pleasure to children of all ages, and their disappearance from the wild life of a locality creates a more deeply felt blank than would the passing of many a nobler animal.

MARSH RABBIT: Sylvilagus palustris
and its relatives

(*For illustration, see Color Plate, page* 184)

The marsh rabbit, or "pontoon," as it is known in Georgia, is a distinctively American species allied to the cottontails, but distinguished from them by its more heavily proportioned body, smaller ears, shorter and slenderer legs and feet, and shorter, nearly unicolored tail. Its only close relative in the United States is the swamp rabbit, known in Alabama as the "cane-cutter."

These two species appear to be members of a tropical American group of which other members are the wood rabbits of Mexico, Central and South America. The distribution of the group was probably at one time continuous, but a change to arid conditions in northeastern Mexico and Texas isolated the two species remaining in this country.

The distribution of the marsh rabbit is limited to the southeastern coastal States from Dismal Swamp, Virginia, to Mobile Bay, Alabama. It is common in suitable places in Florida. Its larger relative, the swamp rabbit, ranges west from this area to Texas and up the Mississippi Valley to Illinois and southeastern Kansas. Swamp rabbits are numerous in the low, wooded coastal region of Louisiana. They are larger and longer-legged than marsh rabbits and fleeter of foot.

Among all the rabbits of the world the marsh and swamp rabbits are the only species which have aquatic habits. Both live mainly in marshes, wooded swamps, and along the low wooded courses of streams. Other rabbits and hares are occasionally known to cross water by swimming, but the marsh and swamp rabbits live about the water and take to it with all the freedom of a muskrat or mink. The marsh rabbit appears to be the more aquatic of the two, as the swamp rabbit sometimes lives in the forest farther back from the water.

The tropical wood rabbits are inhabitants of the dense forests, where they are well hidden beneath the rank undergrowth. They are not known to enter the water, but, like their Northern relatives, make runways through the dense vegetation they frequent. The marsh rabbits live in cypress or other fresh-water swamps, heavily wooded bottoms, and fresh-water as well as brackish marshes. They feed on a variety of vegetation growing in such places and dig up such edible roots as the wild potato and amaryllis.

Both marsh and swamp rabbits have several litters of from two to six young each season, beginning in April. The young are born in large, well-made covered nests, which are built of rushes, grasses, and leaves and lined with hair from the parents. The nests, which have an entrance on one side, are usually located in the midst of dense growths of vegetation or on tussocks, in low, swampy places, and are sometimes surrounded by water. In the most frequented parts of marsh and swamp these rabbits make well-trodden trails through the dense vegetation.

When alarmed, marsh rabbits run for the nearest water, into which they plunge and swim quickly to the shelter of aquatic plants or other cover. When cut off from escape by water they try to avoid capture by doubling and turning, but are so short-legged that they are readily overtaken by a dog.

The tracks of these rabbits in the mud differ from those of the cottontails in showing imprints of the spreading toes.

In South Carolina Bachman once found numerous marsh rabbits in the thickets about recently flooded rice fields and swamps. When he beat the bushes the rabbits plunged into the water and swam away so rapidly that some escaped from a Newfoundland dog which accompanied him. Several, apparently thinking themselves unnoticed, stopped and remained motionless about 15 yards from the shore, with only their eyes and noses showing above water. Thus concealed in the muddy water, with ears laid flat on their necks, they were difficult to see. When touched with a stick they appeared unwilling to move until they saw that they were discovered, when they quickly swam away.

Later, when the water subsided to its regular channels, where it was about eight feet deep, many of the rabbits were seen swimming about, meeting and pursuing one another as if in sport. One which Bachman had in captivity during warm weather would lie for hours in a trough partly filled with water, with which the cage was furnished.

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CHAPTER XII

Even-toed Hoofed Mammals: Collared Peccary, American Elk, Black-tailed Deer, Mule Deer, Virginia White-tailed Deer, Arizona White-tailed Deer, and Moose

THE members of the Order *Artiodactyla* may be distinguished from all other mammals by the horny-hoofed two middle toes upon which they walk. The order is made up of an extraordinarily varied combination of animals, including the pigs, bisons, wild buffalo, cattle, goats, sheep, camels, all of the deer kind, antelopes, and giraffes.

From this heterogeneous collection of beasts ancient man in the Old World subdued to his use all of the most important of our domestic animals, except the horse and donkey, which belong in another group. When Europeans came to America they brought all their domesticated animals with them, although representatives of all the groups under domestication, except the horse and donkey, were already in the New World. As a consequence our large native hoofed animals have continued to remain as a natural supply of wild game.

Unfortunately, advancing occupation of the New World by civilized man and his domestic animals is crowding back, more and more, the fine native fauna of large animals until the point has been reached beyond which they can be perpetuated only by wise conservation.

In America north of the Mexican boundary the *Artiodactyla* are represented by four families.

PECCARIES ARE AMERICA'S ONLY WILD PIGS

The numerous and extraordinarily varied kinds of wild pigs in the Old World are represented in America only by the peccaries, a specialized family, *Tayassuidæ,* containing two genera and two species of small pigs peculiar to North and South America. One of the many differences between them and their Old World relatives is in their having but two young. The name "musk hog" commonly applied to them is based on their possession of a large gland on top of the middle of the rump, which emits a powerful odor. This odor quickly permeates the flesh of the animal if not cut out promptly after it is killed.

The single species of the collared peccary, Genus *Pecari,* a smaller animal than the other genus of peccary, is the only one coming within our southern border. The peccaries go in droves in much of their range, but within the southern United States they are more scattered than farther south.

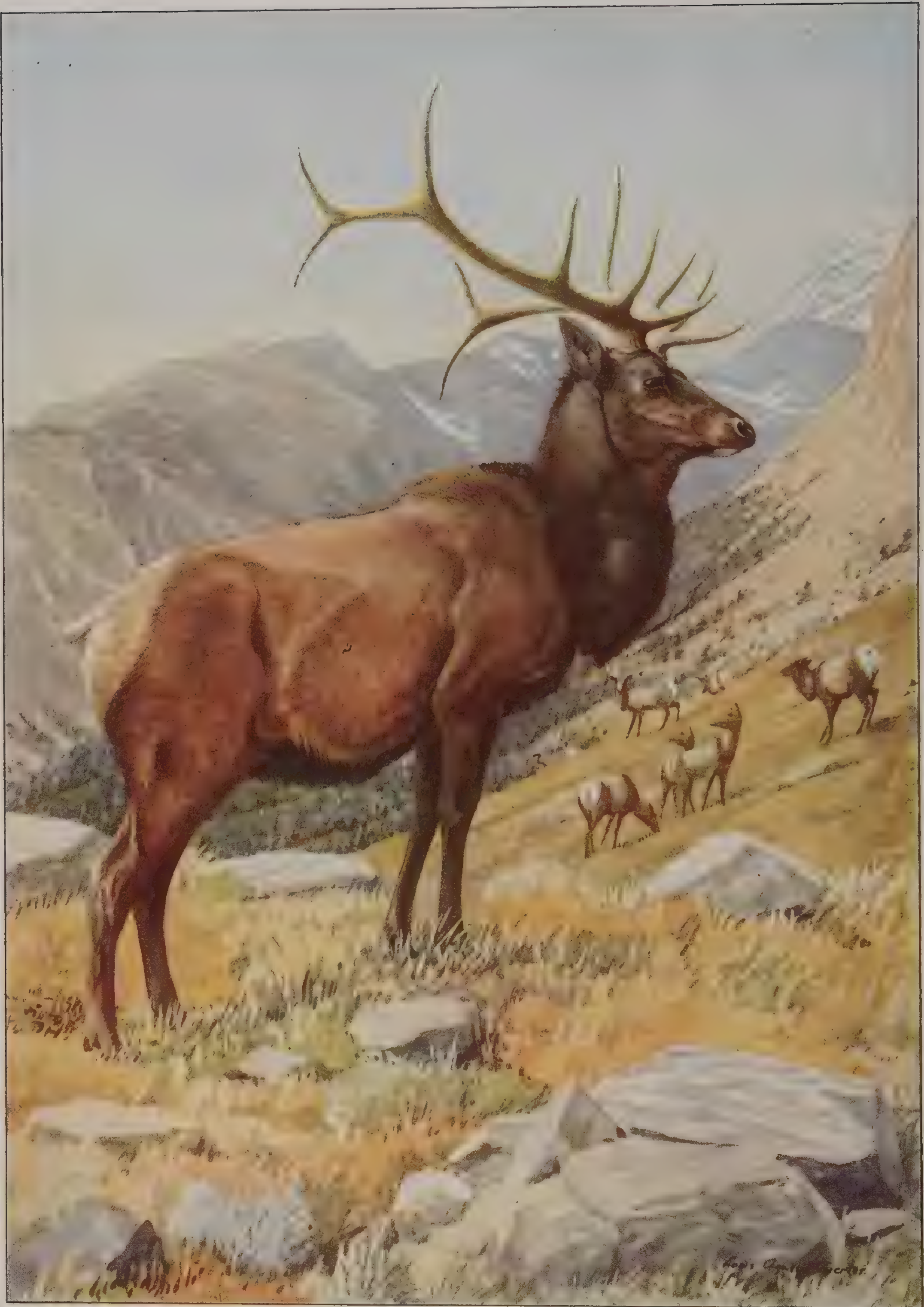
MALES OF ALL THE DEER FAMILY HAVE ANTLERS

The deer family (*Cervidæ*) is characterized by the antlers borne by the males, and also by female reindeer. Many genera and species of the deer kind are distributed in various parts of Europe, Asia, North Africa, North and South America. They are absent from Australasia and most of Africa. In Asia deer have reached a far more varied development than elsewhere.

The members of this group vary greatly in size and appearance, from the little muntjac of southeastern Asia to the giant moose of Alaska. In North America north of the Mexican boundary are four genera, three of which are circumpolar in distribution.

American elk, the red deer of the Old World, and several related animals of Asia, of the Genus *Cervus,* are usually large animals with great, symmetrically branched antlers that give them a noble appearance. The American elk is one of the largest and handsomest of the group.

Black-tailed, mule deer, and white-tailed deer, of the Genus *Odocoileus,* are peculiar to America, mainly to the northern continent but represented in the northern half of the southern one also. The members of this group north of the Mexican boundary, where it has its greatest development, are beautiful representatives of the deer family. One species or another of the four or five with their subspecies within our limits is known to practically every sportsman in the United States and Canada. The white-tail is the most common



WAPITI, or AMERICAN ELK
Cervus canadensis

and widely distributed and is the favorite game animal of hundreds of thousands of sportsmen.

In the tropical forests of Mexico, Central, and northern South America exist the brockets, very small in size, with short, spikelike antlers. South America also has several kinds of deer very different from any to the north.

THE MOOSE IS OUR LARGEST DEER

The moose (Genus *Alces*), largest of the deer family, has a circumpolar range from the Scandinavian Peninsula eastward through northern Europe and Asia and across Bering Strait through Alaska and Canada to Nova Scotia, in mixed coniferous and deciduous forests. The Scandinavian animal, known as the elk, is the smallest and has proportionately the smallest antlers, contrasting strongly with its great Alaskan cousin. Probably only a single species of moose exists, and it has been changed by environment to a number of subspecies in North America, Asia, and Europe.

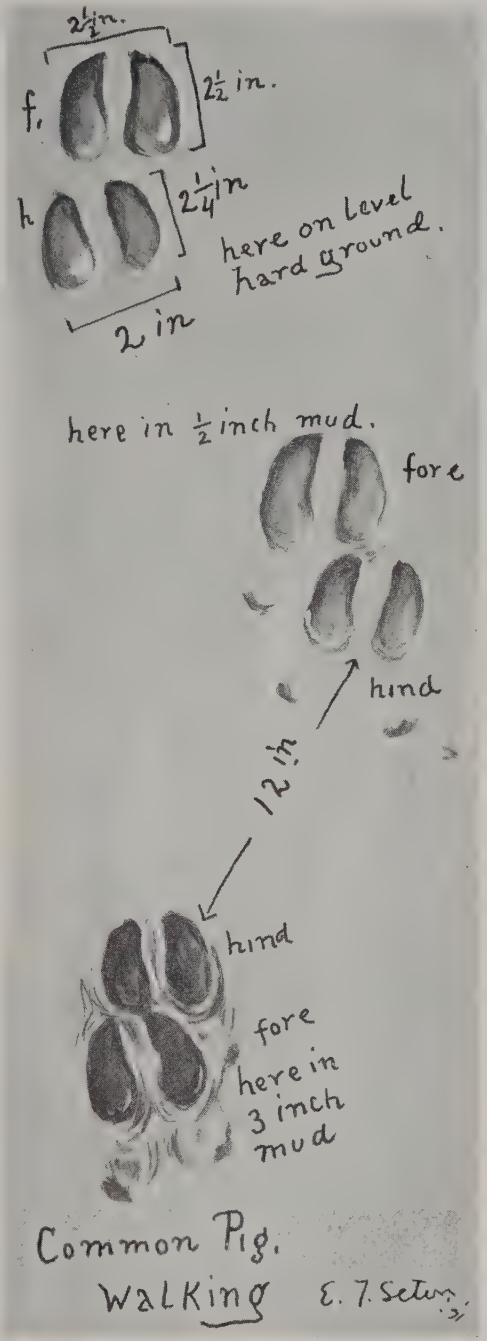
COLLARED PECCARY, OR MUSK HOG: Pecari angulatus

(*For illustration, see Color Plate, page* 184)

The collared peccary is the smaller of the two species, usually weighing less than 75 pounds. It ranges from the southwestern United States south to Patagonia. Within this range numerous geographic races have developed, varying from light grizzled gray to rusty brown and nearly black. It formerly occurred within our border north to the Red River of Arkansas, but is now limited to the southern half of Texas and the southern parts of New Mexico and Arizona.

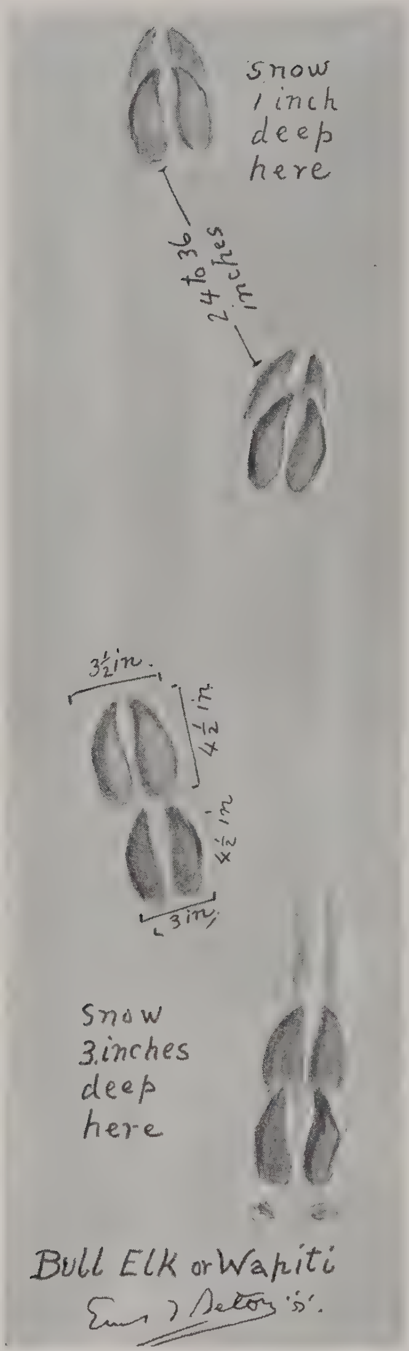
In tropical America collared peccaries are found in dense forests or in low jungles, but in northern Mexico and the southwestern United States they are equally at home among scattered thickets of cactus and other thorny plants on plains and in the foothills. They are strictly gregarious and live in bands of from a few individuals up to 30 or more, usually led by the oldest and most powerful boar. They are omnivorous, feeding on everything edible, from roots, fruits, nuts, and other vegetable products to reptiles and any other available animals. They are specially numerous in many tropical forests where wild figs, nut palms, and other fruit-bearing trees provide abundant food. In the arid northern part of their range dense thickets of cactus and mesquite afford both food and shelter. Their presence in a locality is often indicated by the rooted-up soil where they have been feeding.

Young peccaries become very tame and make most intelligent and amusing pets. One moonlight night on the coast of Guerrero two of us,



TRACK OF A COMMON PIG

Pig and deer tracks are often found in the same places, and at a casual glance may be mistaken for each other, but the bluntness of the pig track distinguishes it. The clouts or hind hoofs do not show on level ground, but do in one or two inches of snow or mud. (See deer tracks on pages 206, 212, and 222).


Snow 1 inch deep here
24 to 36 inches
3½ in.
4½ in.
4½ in.
3 in.
Snow 3 inches deep here
Bull Elk or Wapiti

WALKING TRACK OF LARGE MALE ELK

Each hoof-mark is about 4½ inches long. The track is deerlike in type, but has a little of the roundness of point of the domestic cow. At the upper end of the drawing is snow one inch deep. Here no clouts show; at the lower end it is three inches deep, so the clout-marks are clear. Size is essential in distinguishing the track.

after a bath in the sea by a small Indian village, strolled along the hard white sand to enjoy the cool breeze. Suddenly a little peccary, not weighing over eight or ten pounds, came running to meet us and, after stopping at our feet to have its head scratched, suddenly circled about us, away and back again in whirling zigzags, with all the joyous frenzy of a playful puppy. Continuing this performance, it accompanied us for several hundred yards, until we returned to the village.

Tales of the ferocity of bands of the collared peccaries and of their treeing hunters who have disturbed them read well to the novice, but have little foundation in fact. In reality the animals are shy and retiring and fight only when forced to do so for self-protection. When brought to bay by dogs or other animals, they fight viciously, and with their sharp, knife-edged tusks can inflict serious wounds. Their natural enemies are mainly the jaguar in the south and bobcats and coyotes, which prey upon their young, in the north.

The increasing occupation of our Southwest has already resulted in the extermination of peccaries from most of their former range within our border, and unless active steps are taken to protect the survivors their days will be few in the land. They are such unique and harmless animals that it is hoped interest in their behalf may be awakened in time to retain them as a part of our wild life.

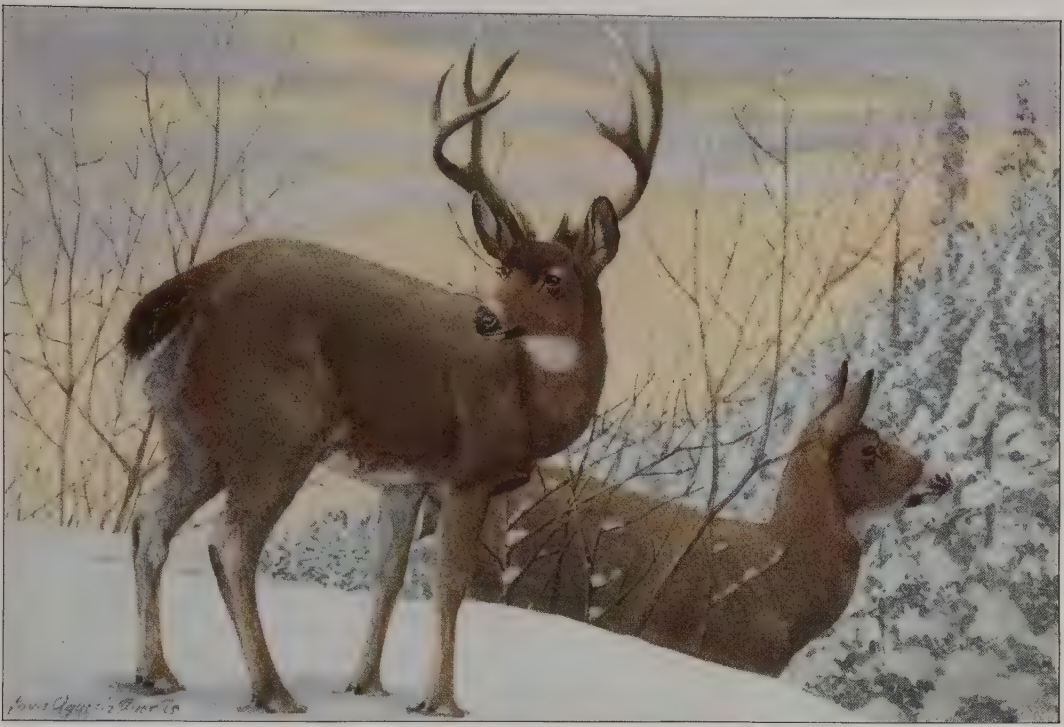
WAPITI, OR AMERICAN ELK: Cervus canadensis and its relatives

(For illustration, see Color Plate, page 202)

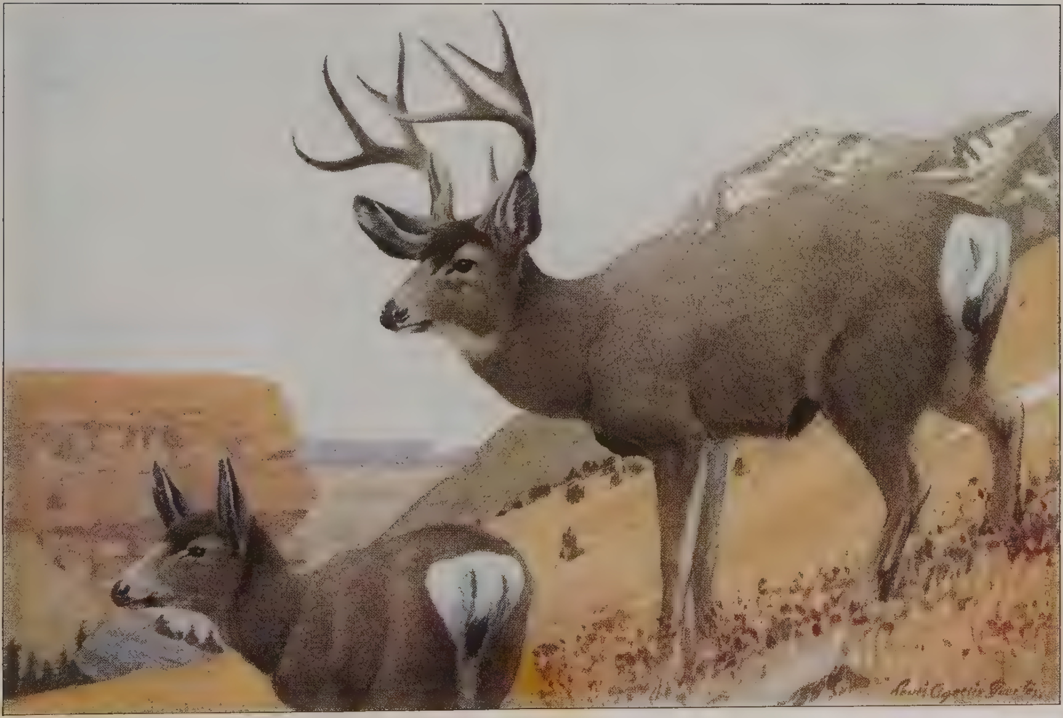
By a curious transposition of names the early settlers applied to the American wapiti the term "elk," which belongs to the European representative of our moose. Our elk is a close relative of the European stag. It is the handsomest and, next to the moose, the largest member of the deer family in America. The old bulls, sometimes weighing more than 800 pounds, bear superb wide-branched antlers, which give them a picturesque and noble mien. This is the only American deer which has a large, well-marked, light rump-patch. The young, numbering from one to three, are white-spotted, like the fawns of most other deer.

Originally the elk was the most wide-ranging of our hoofed game animals. It occupied all the continent from north of Peace River, Canada, south to southern New Mexico, and from central Massachusetts and North Carolina to the Pacific coast of California. Like the buffalo, it appeared to be equally at home in the forested region east of the Mississippi River and on the open plains flanking the Rocky Mountains. Its range also extended from sea level to above timber-line on lofty mountain ranges.

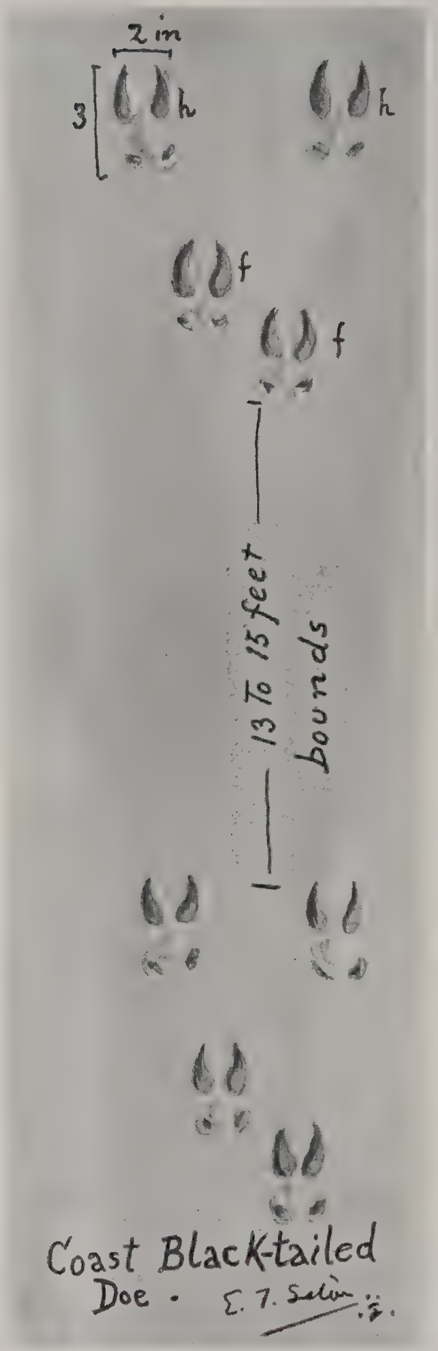
Exterminated throughout most of their original range, elk still occupy some of their early haunts in western Canada, Montana, Wyoming, Colorado, and the Pacific Coast States. The last elk was killed in Pennsylvania about 80 years ago, and in Michigan and Minnesota some 20 years later. The main body of the survivors are now in the Yellowstone Park region. Their



COLUMBIA BLACK-TAILED DEER
Odocoileus columbianus



ROCKY MOUNTAIN MULE DEER
Odocoileus hemionus



COAST BLACK-TAILED DOE

Nothing except probabilities will enable the observer to distinguish the walking tracks of the coast deer, of restricted range, from those of nearly related species. This track of a bounding female shows a peculiar grouping that corresponds fairly with the bounding action characteristic of the species.

size and the readiness with which they thrive in captivity has led to serious consideration of elk farming as an industry.

In the West, before the settlement of their range crowded the elk back, large numbers lived throughout the year on the plains and among the foothills. They have now become mountain animals, spending the spring and summer largely in the timber-line forests and alpine meadows, where many bands linger until the heavy snows of early winter force them down to the foothills and valleys. During the last days of their abundance in the Rocky Mountains winter herds numbering thousands gathered in Estes Park and other foothill valleys.

Elk are the most polygamous of all our deer, each bull gathering a small herd of cows during the fall. At the beginning of the mating season the bulls wander widely through the high forest glades, their musical bugling piercing the silence with some of the most stirring notes of the wilderness. Amid the wild grandeur of these remote mountain fastnesses the appearance of a full-antlered buck on the skyline of some bare ridge presents a noble picture of wild life.

There are probably over 40,000 elk still left in the United States, and of these more than 30,000 are located in Wyoming, mainly in and about Yellowstone National Park.

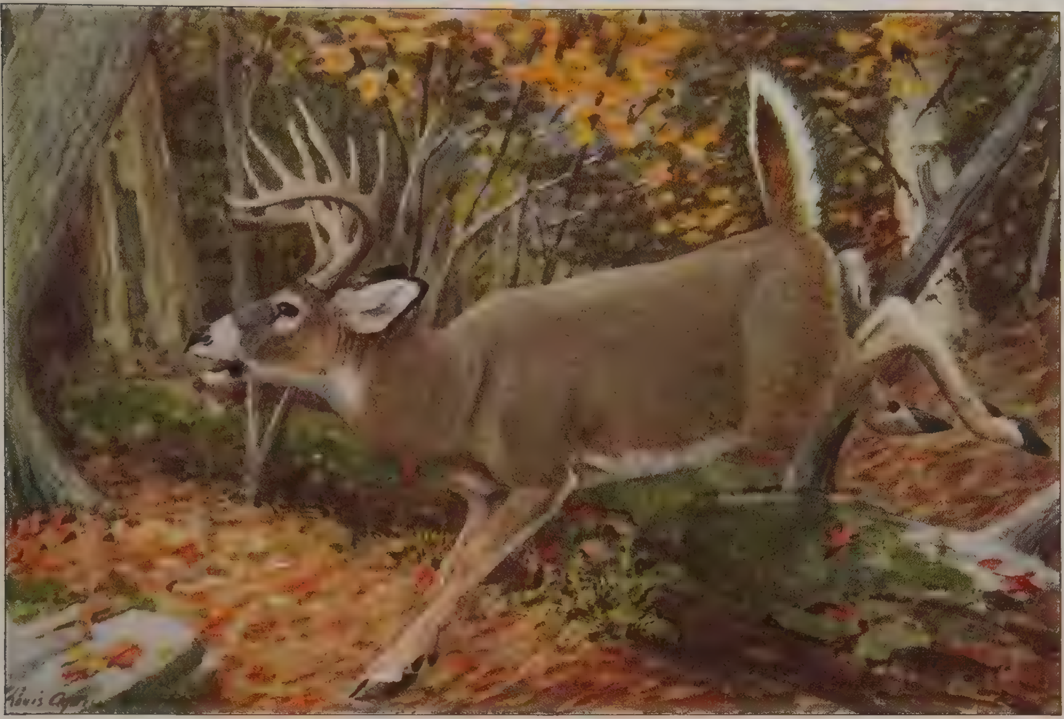
During the last few years great interest has been shown in the reintroduction of elk in parts of their former range, where they had been exterminated and where conditions are still suitable for their perpetuation. Such efforts are meeting with much success. Not only do the animals thrive and increase rapidly, but from the first local sentiment has been strongly in their favor. This is well shown by the active interest taken by both cattle and sheep owners in northern Arizona in regard to a band of elk introduced a few years ago on their mountain stock ranges. The stockmen exercised a virtual wardenship over these animals that insured them against molestation, and the herd rapidly increased. One difficulty with introduced elk is their rapid increase. In a number of places where their range was limited they encroached on the stock growers and farmers, creating much antagonism.

As against this, we have the despicable work of poachers, who shoot elk for their two canine teeth and leave the body to the coyotes. Information has been received that more than 500 elk were ruthlessly slaughtered for this purpose about the border of Yellowstone National Park during the winter of 1915-1916.

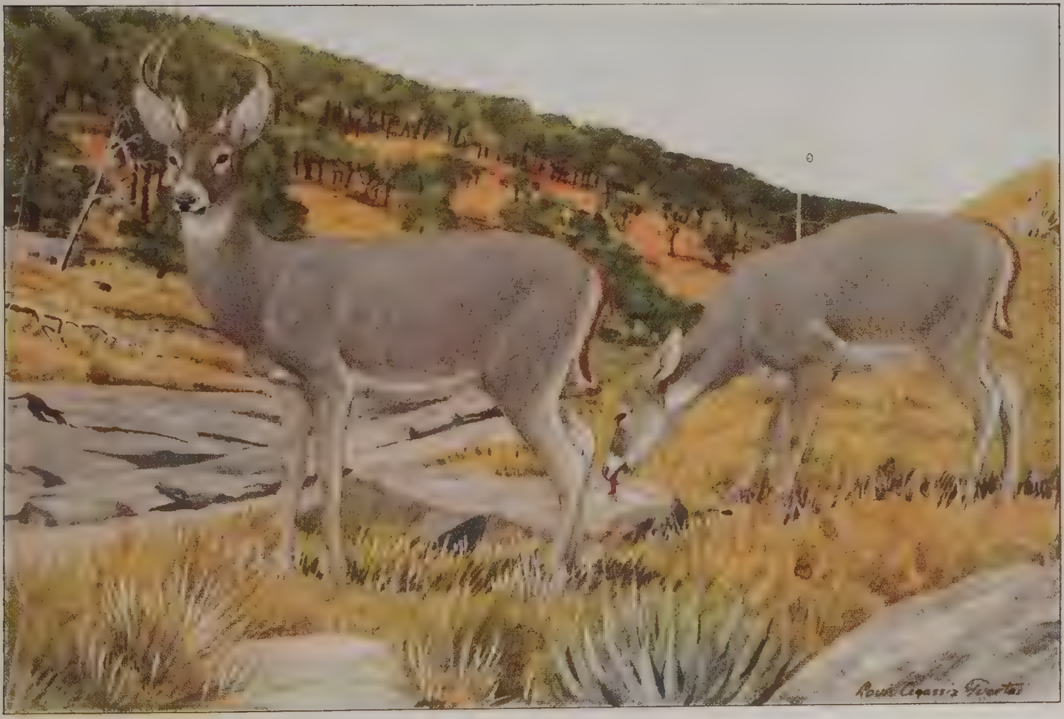
COLUMBIA BLACK-TAILED DEER: **Odocoileus columbianus** and its subspecies

(*For illustration, see Color Plate, page* 205)

In general appearance the black-tails have a close resemblance to the mule deer, but average smaller. They have the same large ears, forked tines to the antlers, and rather "stocky" body; but the brushy all-black tail distinguishes them from any other American deer. In color they have much the same shade of brown as the Virginia deer. They have the usual cycle of an-



VIRGINIA, or WHITE-TAILED, DEER
Odocoileus virginianus


Louis Agassiz Fuertes

ARIZONA WHITE-TAILED DEER
Odocoileus couesi

nual changes common to most American deer—assuming a dull coat in fall and losing their horns in winter, followed by the resumption of a brighter coat in spring and the renewal of their horns in summer.

The black-tails have one of the most restricted ranges among our deer. They are limited to the humid heavily forested belt along the Pacific coast from Juneau, Alaska, southward to the Coast Range in central California. This coastal belt is characterized by superb growths of cedars, spruces, and firs in the north and by redwoods and firs in the south, uniting to make one of the most magnificent forest areas in the world. Here the deer live in the midst of rank undergrowths of gigantic ferns and other vegetation as luxuriant in many places as in the humid Tropics.

Their home on the abruptly rising slopes of the islands in the Alaskan archipelago is so restricted that both in summer and winter they fall an easy prey to native and white hunters. It has been reported that formerly there has been much wasteful killing of the deer on these islands for commercial purposes. When the heavy snows of winter force the deer down to the shore, great numbers of them are also killed by wolves.

Black-tails commonly have two or three young, and this fecundity, combined with the effective protection given by the dense forest where many of them live, will aid in their perpetuation. At the same time they have not developed the mental alertness of the Virginia deer, and there is imminent need for effective action in safeguarding them in the Alaskan part of their range if they are not to be exterminated on some of the islands. Fortunately, under the present Alaska game law the wanton destruction, once operative, has ended and a vigilant game commission is actively guarding their interests. In this northern region the black-tails share their range with strange tribes of coastal Indians, whose huge sea-going canoes, totem poles, and artistic carvings are unique among native Americans.

ARIZONA WHITE-TAILED DEER: **Odocoileus couesi**

(*For illustration, see Color Plate, page* 207)

The Arizona white-tails are slight and graceful animals, like pygmy Virginia deer, so small that hunters often ride into camp with a full-grown buck tied back of the saddle. They have two seasonal pelages—gray in winter and more rusty brown in summer. The antlers, very small, but in form similar to those of the Virginia deer, are shed in winter and renewed before the end of summer.

These handsome little deer, the smallest of our white-tails, are common in many of the wooded mountains of middle and southern Arizona, southern New Mexico, western Texas, and in the Sierra Madre of Chihuahua and Sonora, Mexico. By a curious coincidence this area was the ancient home of the Apache Indians and has had one of the most tragic histories of our western frontier.

During summer and early fall in the higher ranges small bands of Arizona white-tails occupy the lower parts of the yellow-pine forests, between 6,000 and 9,000 feet altitude, where they frequent thickets of small deciduous growth about the heads of canyons and gulches. As winter approaches and heavy snowstorms begin, they descend to warm canyon slopes to pass the season among an abundant growth of piñons, junipers, oaks, and a variety of brushwood.

In the White Mountains of Arizona, between the years 1883 and 1890, when wild life was more abundant than at present, I often saw, on their wintering grounds, large herds of these graceful deer, numbering from 20 to more than 100 individuals. Such gatherings presented a most interesting and exciting sight, whether the animals were feeding in unconscious security or streaming in full flight along the numberless little trails that lined the steep slopes. Where these deer live on the more barren and brush-grown tops of some of the desert mountains in southwestern Arizona and Sonora, the snowfall is so light that their summer and winter range is practically the same.

Although far more gregarious than our other white-tails, the herds of Arizona deer break up in early spring. At this time one or two fawns are born, amid early flowers in the charming vistas of the open forest. Very young fawns are hidden in rank vegetation and sometimes left temporarily by their mothers. If a horseman chances by, the fawns may rise and follow innocently at the horse's heels. On such occasions I have had difficulty in driving them back to prevent their becoming lost.

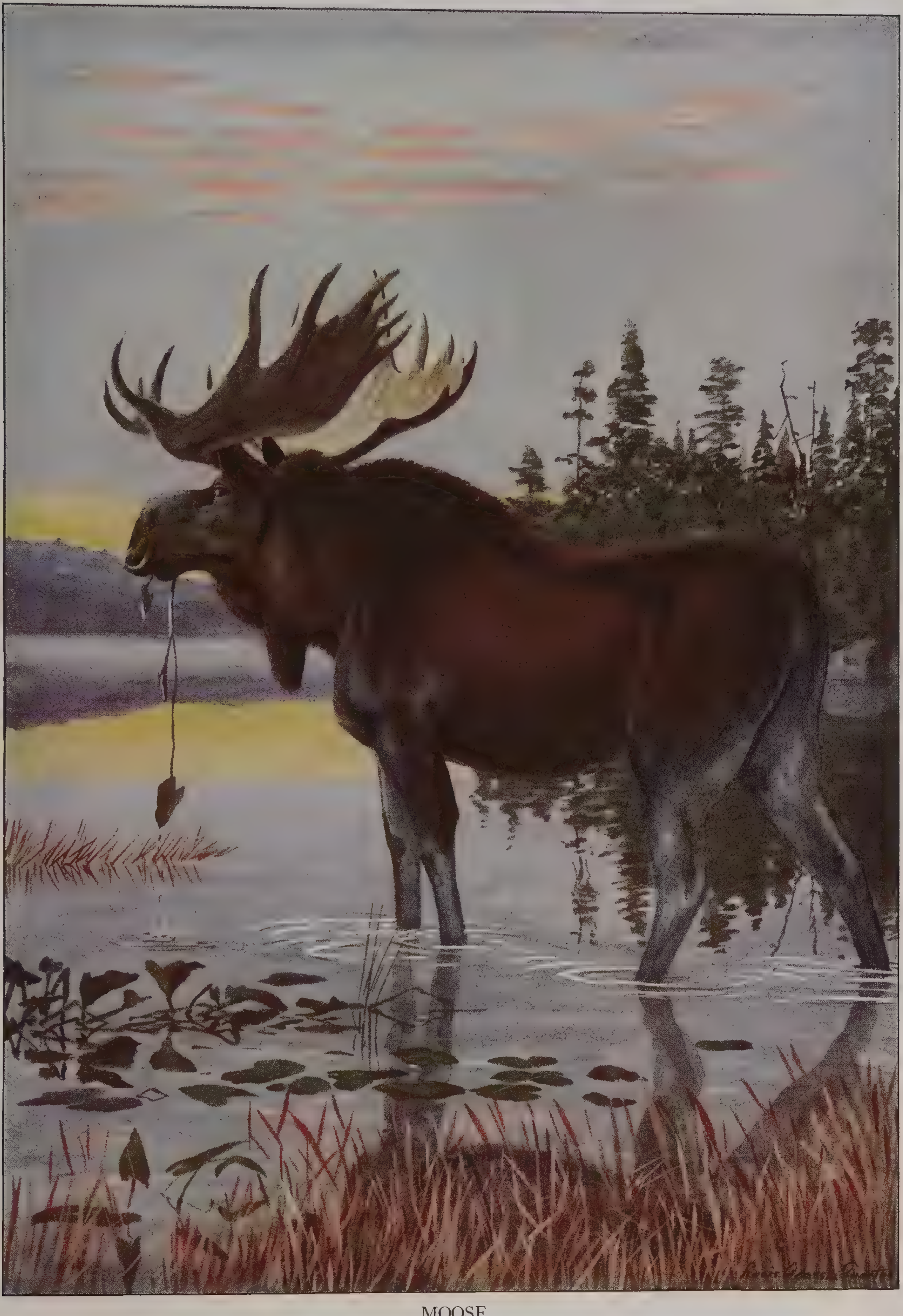
In the Sierra Madre of Chihuahua one summer I found these little white-tails occupying forms, like rabbits, located in the sheltering matted tops of fallen pine trees which had been overthrown by spring storms. In these shelters they rested during the middle of the day, secure from the wolves and mountain lions which prowled about the canyon slopes in search of prey.

With the growing occupation of their territory by cattle and sheep and the increase in the number of hunters, these once abundant deer are rapidly diminishing. It will require all the increasing care of modern conservation if these attractive denizens of our wilder areas in the Southwest are to be saved from extermination over a large part of their range.

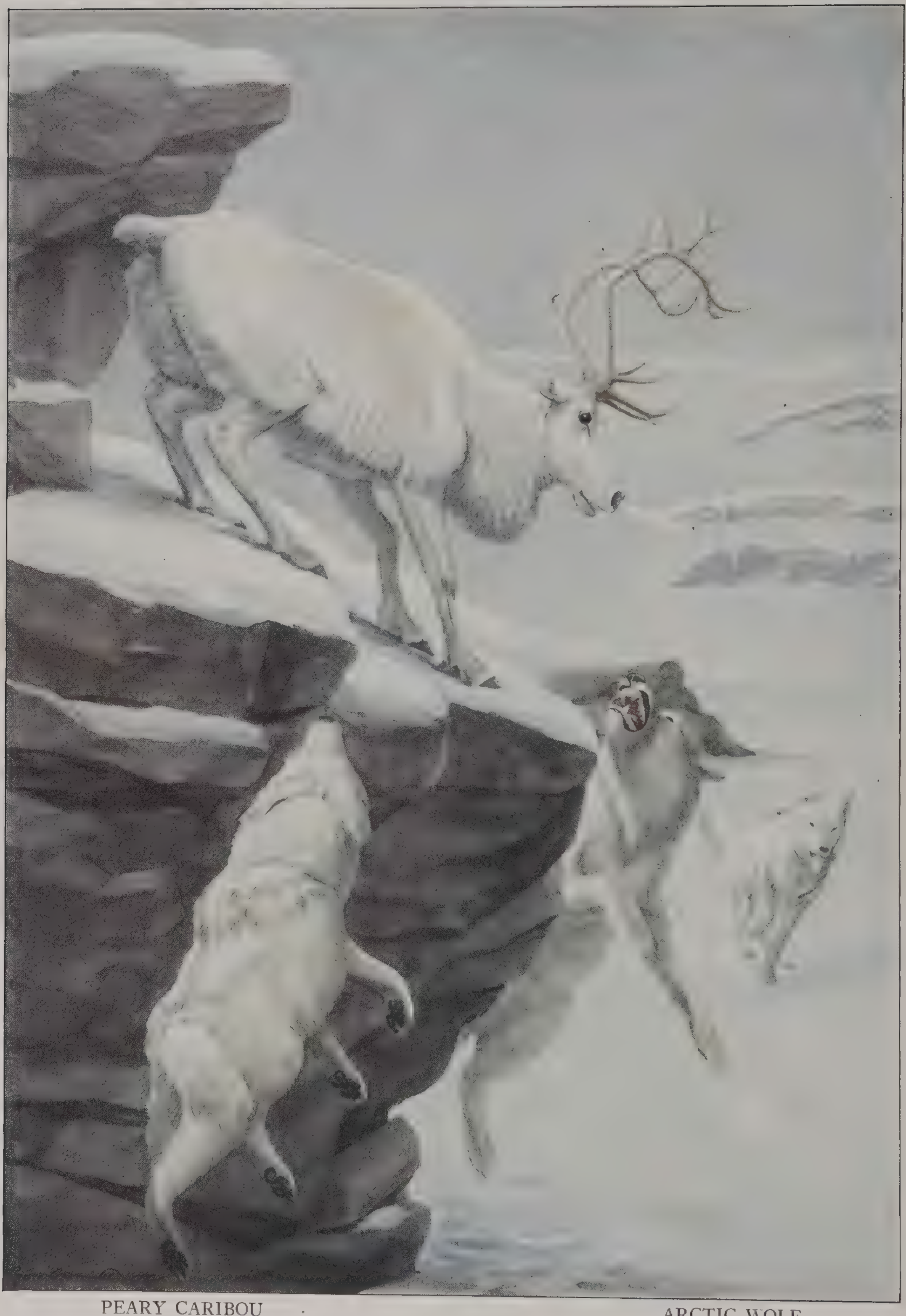
VIRGINIA, OR WHITE-TAILED, DEER: **Odocoileus virginianus**
and its subspecies

(*For illustration, see Color Plate, page* 207)

The aptness of the name "white-tail" for the Virginia deer is obvious to any one who has startled one in the forest and seen it dash away with the tail upright and flashing vivid white signals at every leap. The adults have two strongly contrasted coats each year: brownish gray in winter and rusty red in summer. The fawns, usually two in number, are dull, rusty brown, marked with a series of large white spots which remain until the gray winter coat



MOOSE
Alces americanus



PEARY CARIBOU
Rangifer arcticus pearyi
The most northern form of the Barren Ground caribou, which, like the wolves and arctic hares of its region, is almost or entirely white.

ARCTIC WOLF
Canis tundrarum

is assumed in the fall. Large bucks sometimes attain a weight of more than 300 pounds.

The white-tail is the well-known deer of all the forest areas in eastern North America. Its various subspecies range from northern Ontario to Florida and from the Atlantic coast to the Great Plains; also in the Rocky Mountains south to New Mexico, and in the Cascades and Sierra Nevadas to northern California. Beyond our borders white-tails of varying characters, but not strikingly unlike some of the white-tails in the United States, range down to northern South America.

The supreme importance of this deer to the early settlers of the Eastern States is made plain in all the literature covering the occupation of that region. Its flesh was one of the most reliable staples in the food supply, and not infrequently was the only resource against starvation. In addition, the tanned skins served for clothing and the sinews for thread. Many of the most striking and romantic characters in our early history appear clad in buckskin, from fringed hunting shirt to beaded moccasins.

As no other American game animal equaled the white-tail in economic value to the settlers, so even to-day it remains the greatest game asset in many of the Eastern States. Partly through protective laws and partly through its acute intelligence and adaptability, the Virginia deer continues to hold its own in suitable woodland areas throughout most of its former range, and in recent years has pushed hundreds of miles northward into new territory in Ontario and Quebec.

Even in the oldest and most densely populated States, as New York and Massachusetts, white-tails still exist in surprising numbers. Over 7,000 were killed during the hunting season of 1915 in Maine, and an average of about 2,800 are killed yearly in Vermont. Probably 40,000 of them are now killed annually within 300 miles of New York City.

The great recreational value of the white-tail to a host of sportsmen is obvious. To the growing multitude of Nature lovers the knowledge that a forest is inhabited by deer immediately endows it with a mysterious charm.

In summer white-tails are usually solitary or wander through the forest in parties of two or three. In winter, where the snowfall is heavy, they gather in parties, sometimes of considerable size, in dense deciduous growth where food is plentiful. There they remain throughout the season, forming a "yard" by keeping a network of hard-beaten paths open through the snow in order to reach the browse afforded by the bushes and trees.

Ordinarily Virginia deer are shy and elusive inhabitants of dense forests, where they evade the unpracticed intruder like noiseless shadows. Where they are strictly protected for a period of years under State laws, they become surprisingly confident and often damage young orchards and crops on farms near their haunts. Several States pay for the damage thus done. Happily this attractive species thrives so well under protective laws that its continued future in our forests appears to be assured.

MOOSE: Alces americanus and its subspecies

(*For illustration, see Color Plate, page* 209)

The American moose is a large cousin of the elk of the northern forests of Europe and Siberia. The European animal is characterized not only by its smaller size, but also by smaller antlers. The moose is a large, grotesquely formed animal, with the most impressive individuality of any of our large game. Its great head, with oddly formed nose, huge palmated antlers, pendulous bell under the neck, short body, and disproportionately long legs, unite to lend the impression that it may be a strange survivor from some remote geologic period.

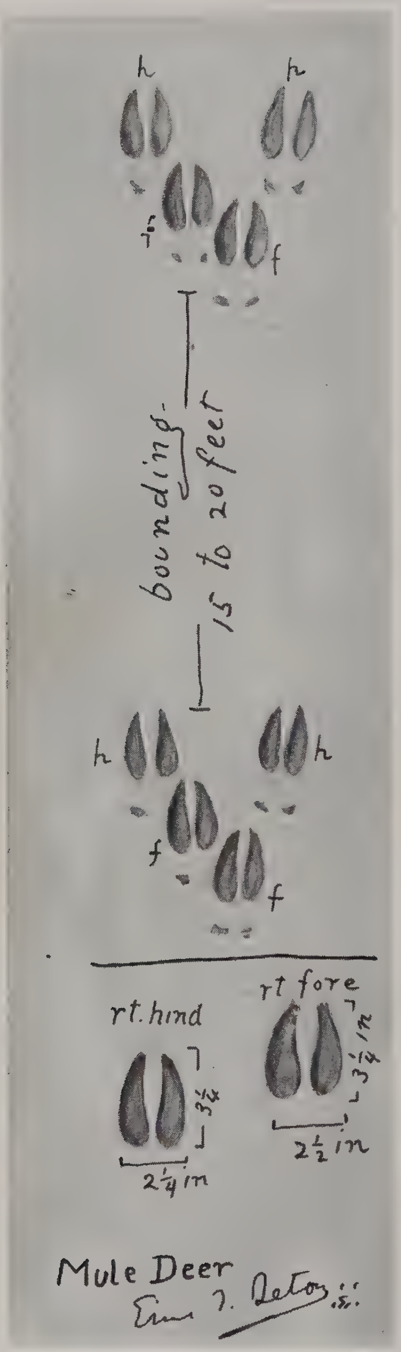
The moose inhabits our northern forests, where it wanders among thickets of spruce, tamarack, birch, aspen, and alder, from the mouth of the Yukon and the lower Mackenzie southward to Maine, northern Minnesota, and down the Rocky Mountains to Wyoming. It varies in size in different parts of its range. The bulls of the Kenai Peninsula and adjacent region in Alaska are probably the largest of their kind in the world, sometimes weighing more than 1,400 pounds. The enormous antlers of these great northern beasts attain a spread of more than six feet and make the most impressive trophy the big-game hunter can secure in America.

Although taller than an ordinary horse, weighing more than half a ton, and adorned with wide-spreading antlers, the bull moose stalks with ghostly silence through thickset forests, where man can scarcely move without being betrayed by the loud crackling of dry twigs. In summer it loves low-lying, swampy forests interspersed with shallow lakes and sluggish streams. In such places it often wades up to its neck in a lake to feed on succulent water plants, and when reaching to the bottom becomes entirely submerged. These visits to the water are sometimes by day, but usually by night, especially during the season when the calves are young and the horns of the bulls are but partly grown.

Late in the fall, with full-grown antlers, the bulls wander through the forest looking for their mates, at times uttering far-reaching calls of defiance to all rivals, and occasionally clashing their horn against the saplings in exuberance of masterful vigor. Other bulls at times accept the challenge and hasten to meet the rival for a battle royal. At this season the call of the cow moose also brings the nearest bulls quickly to her side. Hunters take advantage of this, and, by imitating the call through a birch-bark trumpet, bring the most aggressive bulls to their doom.

Ordinarily moose are extremely shy, but during the mating season the males become so bold that when encountered at close range they have been known furiously to charge a hunter. They strike vicious blows with their front feet, as well as with their heavy antlers, and make dangerous foes for man or beast.

The future existence of these superb animals depends upon their receiving proper protection.



MULE DEER

The mule deer tread cannot be distinguished with certainty from that of white-tailed or coast deer (see pages 222 and 206); yet it averages larger than either of these, and the curious close set-together of all four feet while it does its peculiar bounding is unlike the white-tail track.

ROCKY MOUNTAIN MULE DEER: **Odocoileus hemionus** and its subspecies

(*For illustration, see Color Plate, page* 205)

Mule deer are larger than the common white-tails, with a heavier, stockier form. Their strongest characteristics lie in the large double-branched antlers, large broad ears, and rounded whitish tail with a brushlike black tip. Their common name in this country and the name "venado burro" in Mexico are derived from the great, donkeylike ears. Their antlers vary much in size, but in some examples are almost intermediate between those of the white-tail and of the elk. Antlers of the mule deer and of the black-tail agree in having the tines all pronged, in contrast with the single spikes of the white-tails. In summer these deer have a rich, rusty red coat which is exchanged in winter for one of grayish brown.

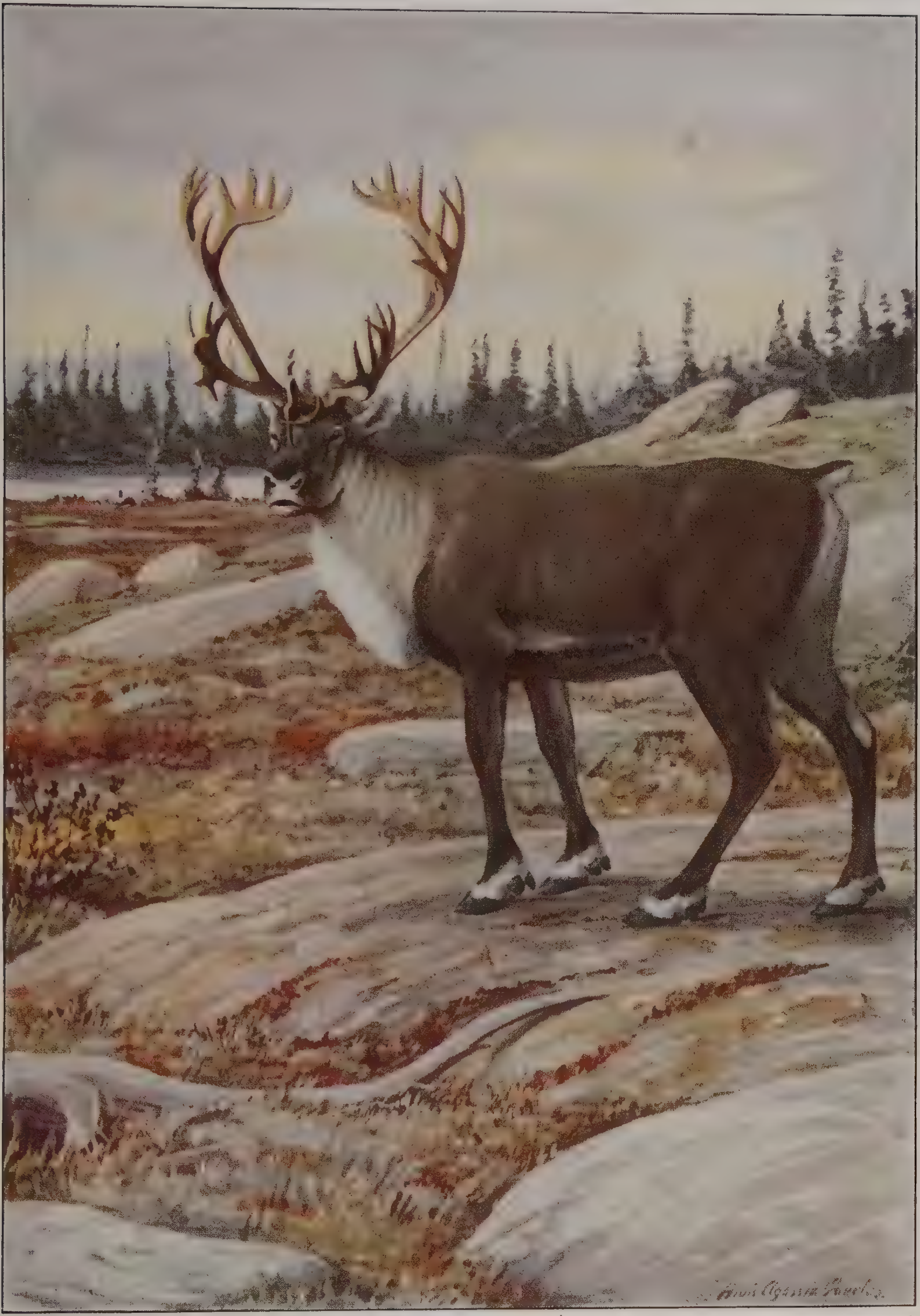
The range of mule deer extends from northern Alberta, Manitoba, and western Iowa to the State of San Luis Potosí, on the Mexican tableland, and west to Lower California and the coast of California. Within these limits they inhabit different types of country, from the deciduous forests along streams on the eastern border of the Great Plains to the open pine forests of the high western mountains, the chaparral-covered hillsides of southern California, and the thickets of mesquites, acacias, and cacti on the hot and arid plains of Sonora. Several geographic races of this deer have resulted from these varied conditions.

In spring in the Rocky Mountains the does leave the bands with which they have passed the winter and seek undisturbed retreats among forest glades or along scantily wooded slopes of canyons. Here they have two or three handsomely spotted fawns with which they remain apart throughout the summer.

The bucks usually keep by themselves during the summer, singly, or in parties rarely exceeding ten. As their horns lose the velvet and the mating season draws near, the old bucks gather in bands of from six to ten.

At this time they are in perfect physical condition, and a band of them in the open forest, with antlers held proudly aloft and their glossy coats shining in the sun, presents a superb picture. They have little of the protective caution so characteristic of the white-tails, and when a shot is fired at a band they often begin a series of extraordinary "buck jumps," bounding high in the air, facing this way and that, sometimes not taking flight until after several additional shots have been fired. These high, bounding leaps are characteristic of mule deer and are commonly made when the animals are suddenly alarmed and often when they are in full flight through brushy thickets.

These deer are not good runners in the open. On several occasions, on level country in Arizona, I have ridden after and readily overtaken parties of them within a mile, their heaving flanks and open mouths showing their distress. The moment rough country was reached, however, a series of mighty leaps carried them away from me with amazing celerity.



WOODLAND CARIBOU
Rangifer caribou

CHAPTER XIII

Woodland and Barren Ground Caribou, Pronghorn Antelope, American Bison, Musk Oxen, Rocky Mountain, Dall, and Stone Sheep, Rocky Mountain Goat

THE caribou, Genus *Rangifer,* or reindeer, as they are termed in the Old World, are a curious type of the deer family, circumpolar in distribution. They are more heavily built than others of the deer kind, with broad, heavy muzzles, rather short, thick legs having very large, deeply cleft hoofs, and a generally clumsy appearance in comparison with the usual grace of outline possessed by most deer. They have remarkably large, curiously branching antlers which are borne by both sexes, those of the female being smaller and slenderer than the male's. This appears to be the only instance in the deer family of the female having antlers.

Caribou are so similar in character throughout their vast range as to raise doubt of the existence of more than a single species with numerous subspecies. This appears with considerable certainty to be the case so far as the animal in North America is concerned. Here, when Europeans occupied our shores, caribou ranged from Maine, Minnesota, and Idaho, north to the Arctic islands and northernmost Greenland. In recent years they have gone from parts of their former range and are on the verge of extinction within the United States.

THE PRONGHORN SHEDS ITS HORNS ANNUALLY

Pronghorn antelopes are the only members of the peculiarly American Family *Antilocapridæ.* They live on the open plains, from near the southern end of the table-land of Mexico north to southern Canada.

The pronghorn is a graceful animal, especially remarkable for its annual molt of the horns, which have a spurlike "prong" or branch above the middle. It has a broad white patch covered with long, erectile, white hairs over the rump, about the tail.

This family, with its species, is the only living representative in America of the antelopes so plentiful in Africa, but differs greatly from any of them. Fossil remains from various parts of the United States indicate that in the geological past this region had numerous antelopes, some being rather closely related to living forms now in Africa.

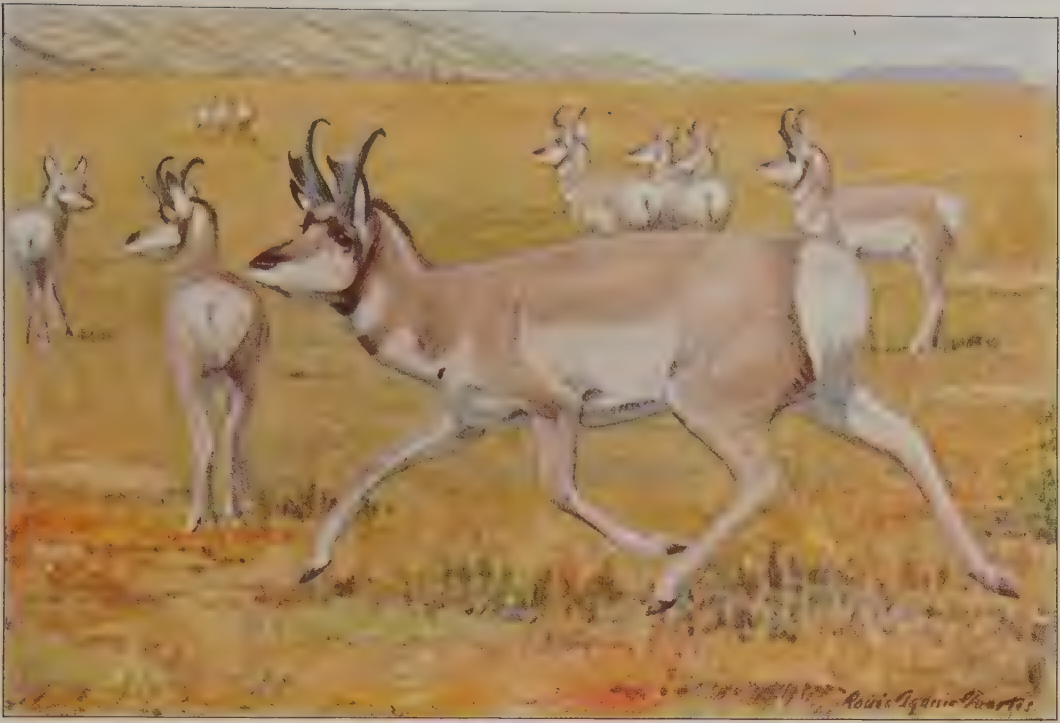
GOATS, SHEEP, BISON, AND MUSK OX BELONG TO SAME FAMILY

In the hollow-horned ruminants of the Family *Bovidæ* we have a collection of animals with many of which every one is familiar, as it includes not only the marvelously varied antelope tribe of Asia and Africa, but the goats, sheep, cattle, both wild and tame, with the musk ox, the bison, the buffaloes, and various related animals.

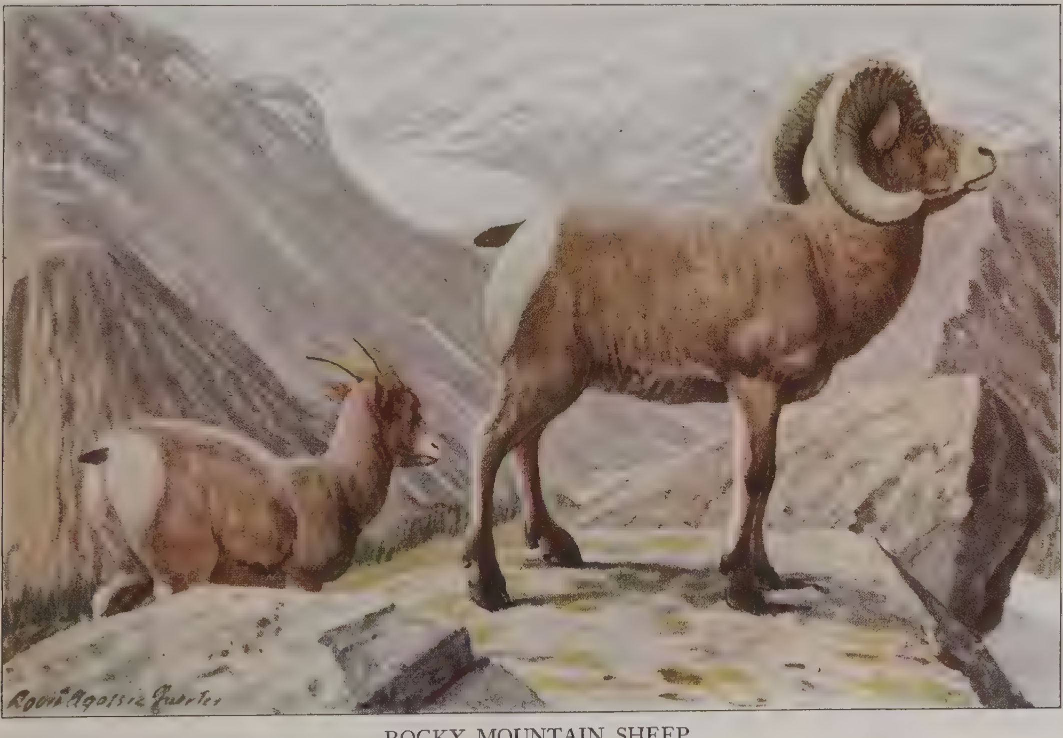
Members of the family exist in a wild state chiefly on the mainland and on many islands off southeastern Asia; also in Africa. One member of the Genus *Bison* barely survives in Europe and another is more numerously represented in North America. Asia and Africa have a great number of genera and species and appear to be the points of origin of many kinds. Fossil records show that North America at various times was also well populated with them. All wild representatives of the family have hollow horns on a bony sheath upon the head, as in the cattle, sheep, and goats.

The European and American bisons are the only two species of the Genus *Bison* in existence. Everyone is familiar with the appearance of the American species. In not distant geological times other species of this genus lived in North America.

The curious, shaggy beast of the icy northlands known as the musk ox, Genus *Ovibos,* was once circumpolar in distribution. The genus now contains but a single species forming two geographic races peculiar to Arctic Canada and Greenland. In ancient times they occupied the treeless northern tundras of the Old World and of North America with the woolly mammoth and other beasts of those days which have all disappeared.


Louis Agassiz Fuertes

PRONGHORN ANTELOPE
Antilocapra americana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ROCKY MOUNTAIN SHEEP
Ovis canadensis

ALL WILD SHEEP HAVE SPIRAL HORNS

Wild sheep, Genus *Ovis,* are widely distributed in the mountains of northern Africa, parts of Europe, most of Asia and North America from Alaska to northern Mexico. Asia appears to be the center of development of these animals, where the noblest of its kind, *Ovis poli,* and its subspecies occur. Mountain sheep all appear very different from the animals man domesticated before the dawn of history. Among the numerous species there is remarkable variation in size and appearance. All are characterized, however, by the spirally coiled horns of the males. In North America are only two species, the larger with its subspecies ranging to the south and the smaller in the north.

In the mountains of the Old World are numerous wild goats of different types, occurring in northern Africa, southern Europe, and especially in Asia, which is the center of their abundance in genera and species. In America the only representative of these animals is the Rocky Mountain goat, Genus *Oreamnos,* which is so different in some of its structural characters as to place it far outside the limits of the typical goats of other regions. It is limited to the mountain ranges of northwestern North America. Despite its differences of internal structure, these animals have a perfectly goatlike appearance and have thus earned their name. This species is divided into two or three geographical races, owing to variations in its range.

BARREN GROUND CARIBOU: Rangifer arcticus and its subspecies

(*For illustration, see Color Plate, page* 210)

The typical Barren Ground caribou is smaller and paler colored than the woodland species. Several geographic races have been distinguished, among which the most notable is the Peary caribou, the palest of all and the subject of the accompanying drawing. Like other members of the group, this species is a heavily built animal, with thick legs and large feet.

The Barren Ground caribou is characteristic of the desolate Arctic barrens and tundras beyond the limit of trees, ranging to the northernmost limit of land beyond 83 degrees of latitude. When explorers first visited these northern wilds, including the treeless coastal belt from the Peninsula of Alaska to Bering Strait, they found caribou almost everywhere in extraordinary abundance. Over great areas of this territory straggling herds, sometimes numbering hundreds of thousands, drifted with the season from one feeding ground to another.

The advent of white men with guns has resulted in their rapid decrease almost everywhere and in their extermination over great areas. In many of their old haunts the only trace of their former abundance is in well-marked trails winding by easy grades to the bare tops of the low mountains. They are still numerous in the Tanana River basin in Alaska and adjacent region in the Yukon Territory of Canada, as well as on parts of the vast Barren Lands of northern Canada. There, on the shores of Artillery Lake, during the summer of 1907 a small migrating herd of about 2,000 was seen, and since then large herds have been seen on the great tundras of that region. In Yukon Territory and the Tanana River region of Alaska the herds are estimated to include hundreds of thousands of animals.

When alarmed caribou often break into a clumsy gallop, which soon changes to a steady shambling trot, their characteristic gait, carrying them rapidly across country. In winter their tracks in the snow show that their feet, instead of being raised high at each step, like those of a Virginia or mule deer, drag through the snow like those of domestic cattle. Their large, broad-spreading hoofs, with sharp, cup-shaped edges, are admirably adapted to secure a firm footing in the yielding and hummocky surface of their haunts in summer and on the snow and ice in winter.

The Barren Ground caribou, living under severe climatic conditions, has developed an extraordinary method of storing up fat to carry it through winter stresses. Early in fall a layer of pure tallow, called "backfat," is formed over the entire top of the back from between the shoulders to the rump. This is a solid slab of tallow lying between the superficial muscles and the skin. It is almost as thin as a knife-blade at the shoulders, but thickens gradually to a depth of from four to six inches at the rump. This slab of tallow is gradually absorbed during the winter and has totally disappeared by spring. In early winter the backfat is easily removed and transported in its original form. It is highly prized as food and as an article of trade among the Eskimo and Indian hunters, and figures as one of the chief delicacies at their winter feasts.

The Peary caribou lives on Ellesmere Island and in extreme northern Greenland to beyond 83 degrees of north latitude, where in places it is common. It appears to thrive on lichens, and other dwarf and scanty Arctic vegetation, and holds its own against the depredations of packs of the white Arctic wolves. In these northern wilds, amid the most intense cold, the caribou passes from three to five months of continuous night, its wanderings lighted only by the moon, stars, and the marvelous displays of waving northern lights.

In northern Europe and Asia Barren Ground reindeer were domesticated in prehistoric times and were introduced in Alaska from Siberia near the end of the last century. There they have increased remarkably and in 1930 are estimated to number more than 500,000, mainly owned by the Eskimos. These newcomers and the native caribou interbreed freely and it appears plain that when the tame reindeer herds cover the Alaskan and northern Canadian ranges the fine geographic races of caribou peculiar to those regions will become assimilated and vanish forever.

In Alaska both natives and white men are developing a new and promising stock industry. The herds of tame reindeer are extremely gentle and easily handled. Their progenitors were like other wild caribou—of a dull and nearly uniform color—but domestication has resulted, as with cattle, in producing endless color variations, from white to black, with every imaginable piebald variation.

The changed conditions of life in Alaska, due to the discovery of gold and subsequent development of that territory, have seriously affected the welfare of the natives. Fortunately the introduction of reindeer herds appears to open a promising future for both Eskimos and Indians.

WOODLAND CARIBOU: Rangifer caribou and its subspecies

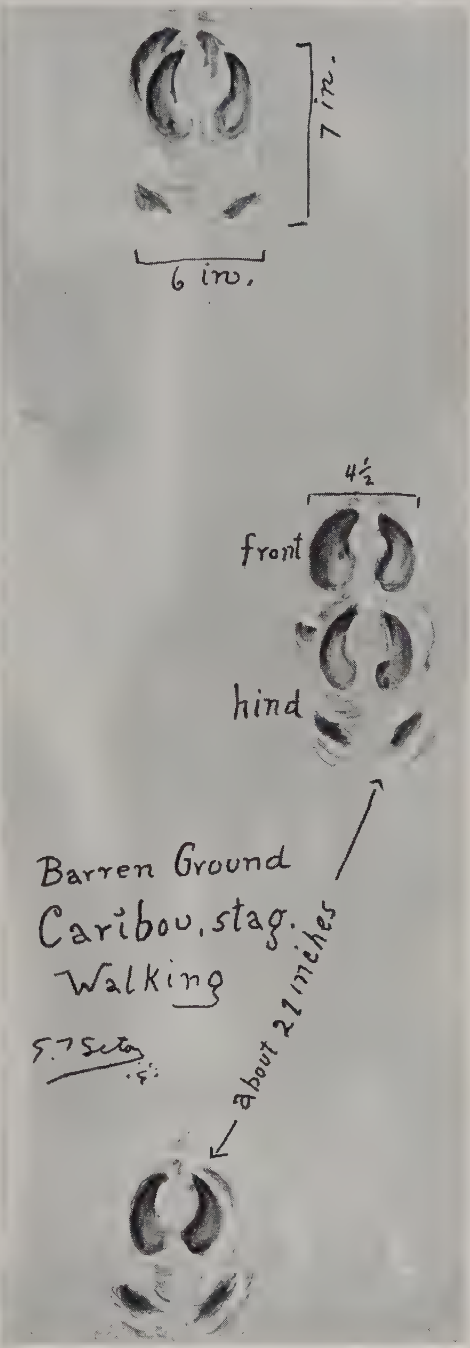
(*For illustration, see Color Plate, page* 213)

The caribou lacks the symmetry and grace of the true deer. Its large head topped with irregular antlers, heavy body, and thick, sturdy legs ending in large, broad-spreading hoofs, produce a distinctly ungainly animal. It is the only member of the deer family in which both sexes have antlers, those of the female being smaller and slenderer than those of the male. It varies in size in different parts of its range, but large old bulls usually weigh from about 200 to 400 pounds. A single calf is the rule, but occasionally there are two.

The woodland caribou, the southern representative of the Barren Ground caribou, inhabits almost the same forests of spruce, tamarack, birch, and alder as those sheltering the moose. Its range covers the southern forested belt in Canada and parts of the northern United States in Maine, Minnesota, and Idaho, but within our borders the animal is nearly extinct. It is far less gregarious than the Barren Ground caribou. During summer only small parties of cows, calves, and partly grown young keep together, while the bulls are solitary or in small separate parties. In winter all unite in larger herds.

The curiously ungraceful appearance of the caribou, so different from other deer, gives it a strong individuality, which seems to belong with its remote haunts in the wilderness. This great animal has an added appeal to our interest, owing to its close relationship to that other woodland caribou which was such an important resource to the cave men of France and other parts of Europe, as shown by bone and horn implements, carvings, and other records discovered in the sites of their homes.

During summer and fall in eastern Canada, where this caribou is distributed through much



BARREN GROUND CARIBOU

The track is distinguished by its great spread and the fact that the clouts or hind hoofs touch the ground, even on a hard surface. Size is the only difference between the tracks of the various caribou and reindeer. Caribou tracks in the snow show that the feet, instead of being raised high, drag like those of domestic cattle.

Photograph by Amos Burg

CARIBOU SWIMMING THE YUKON

The Barren Ground caribou is, with the possible exception of the bowhead whale, the most important animal of the Arctic. There is scarcely anything manufactured that can equal caribou skin as an article of clothing. In many places throughout Arctic Alaska and Canada, the natives live for long periods exclusively upon caribou meat.

of the wilder forests, it has a habit of coming out of the woods to sun itself and bathe on the borders of shallow lakes. Here the old bulls wallow in the water, and on rising shake themselves like a dog, filling the air with a halo of sparkling water drops. In such places the bulls frequently stand basking in the sun for hours.

To a canoeman gliding silently around a jutting point, this rugged inhabitant of the wilds, seen across the shining waters and outlined against the dark-green forest, represents a wonderfully picturesque sight.

When alarmed at such times the caribou dashes shoreward through the water amid clouds of flying spray struck up by its broad feet, and, accompanied by a loud crashing of dry branches, vanishes in the sheltering forest.

The woodland caribou is neither so swift nor so astute in avoiding danger as the Virginia deer or the moose. It falls an easy prey to hunters and to wolves, and when not properly safeguarded is readily exterminated. This is shown by its complete disappearance from Maine and the Adirondacks, in northern New York, and by its threatened disappearance from the forests of Minnesota, and Idaho; in fact, the woodland caribou is in more imminent danger of complete and early extermination within the United States than any other game animal and can be saved only by stringent laws and careful guardianship by State and Federal authorities.

PRONGHORN ANTELOPE: Antilocapra americana and its subspecies

(For illustration, see Color Plate, page 215)

Unique among the antelope of the world, among which it has no near relatives, the pronghorn, because of its beauty of coloration, its grace and fleetness, claims the attention of sportsmen and Nature lovers alike. It is a smaller and slenderer animal than the larger forms of the Virginia deer. Its hair is coarse and brittle, and the spongy skin lacks the tough fiber needed to make good buckskin. Both sexes have horns, those of the doe being smaller and slenderer. One of the extraordinary peculiarities of this antelope is its habit of shedding the horns every fall and the developing of new horns over the remaining bony core.

The rump patch of the pronghorn is formed of long, pure-white hairs, which in moments of excitement or alarm are raised on end to form two great chrysanthemumlike white rosettes that produce an astonishingly conspicuous directive color mark. The power to raise these hairs is exercised by the fawns when only a few days old. Even when the hairs are not erected, the rump patch is conspicuous as a flashing white signal to a distance of from one to two miles as the antelope gallops away. When the animal whose rump signal has been plainly visible at a distance suddenly halts and faces about to look back, as is a common custom, its general color blends with that of the background and it vanishes from sight as by magic.

Early explorers discovered antelope in great abundance over a vast territory extending from near the present location of Edmonton, Alberta, south to near the Valley of Mexico, and from central Iowa west to the Pacific coast in California. They were specially numerous on the limitless plains of the "Great American Desert," where our pioneers found them in great bands containing thousands among the vast herds of buffalo. So abundant were they that it has been estimated that on the Great Plains they equaled the buffalo in numbers. Now reduced to a pitiful remnant of their former numbers, they exist only in widely scattered areas, where they are constantly decreasing. Fortunately they are strictly protected by law in most of their remaining territory. Considerable numbers of pronghorns, running into the thousands, continue to exist up to 1930 in Wyoming, Nevada, and eastern Oregon, and public sentiment is so strongly in their favor that we may hope for their long continuance in these favored areas. Reports have come in of increases of small herds in some of the other States.

The great herds containing thousands of antelope that formerly existed were usually formed late in fall and remained together throughout the winter, separating into numerous smaller parties during the summer. For years following the completion of the transcontinental railroads they were commonly seen from the car windows as trains crossed the Great Plains. At such times their bright colors and graceful evolutions, as they swept here and there in erratic flight or wheeled in curiosity to gaze at the passing train, never failed to excite the deepest interest.

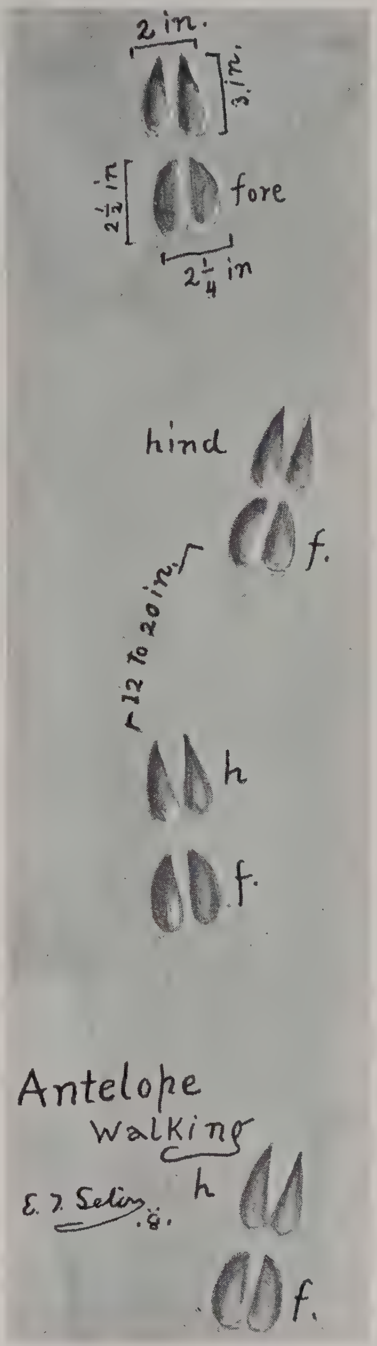
In early days pronghorns were noted for their curiosity and were frequently lured within gunshot by waving a red flag or by other devices. I have repeatedly seen them circle or race a team or a horseman crossing their range. In racing a horseman traveling along an open road or trail, they gradually draw nearer until finally every member of the band dashes madly by only a few yards in front and then straight away across the plains in full flight.

The pronghorns appear to possess a highly nervous temperament, which requires for their welfare the wide, free sweep of the open plains. They do not thrive and increase in inclosures, even in large game preserves, as do deer, elk, and buffalo. For this reason, it will require the greatest care to protect and foster these attractive members of our fauna to save them from soon being numbered among the many wild species which have been destroyed by the coming of civilized man.

AMERICAN BISON, OR BUFFALO:
Bison bison and its subspecies

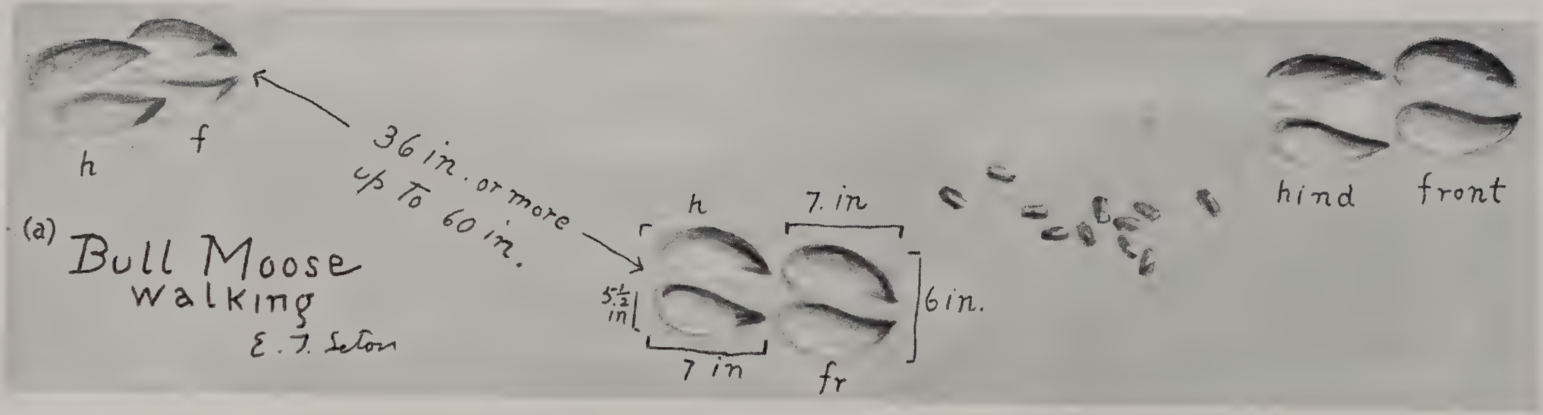
(*For illustration, see Color Plate, page* 225)

The American bison, or buffalo, is a close relative of the large bison which once inhabited Europe and survives in limited numbers in



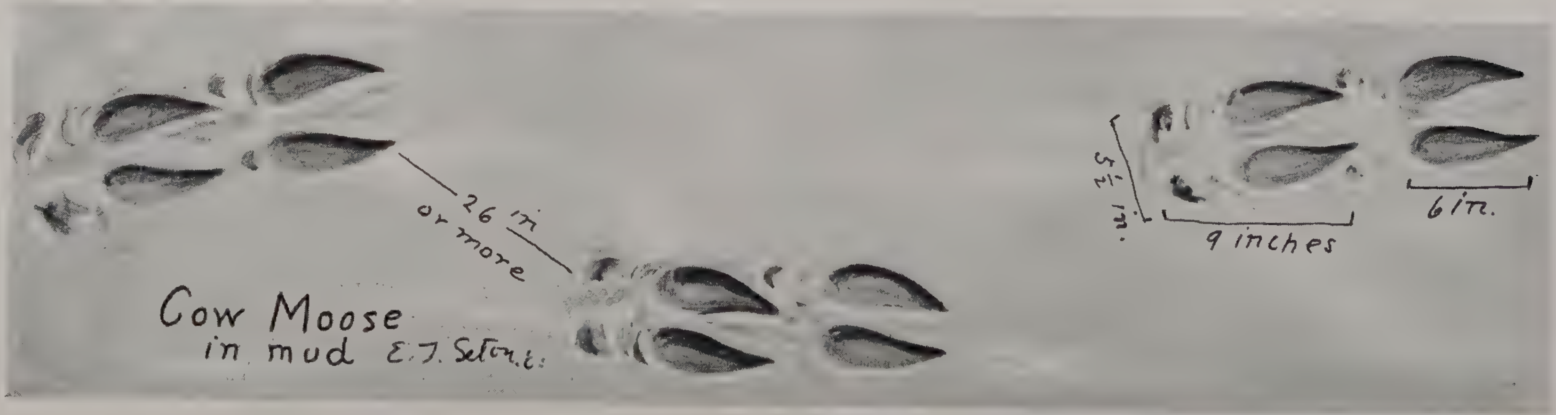
THE ANTELOPE'S TRACK IS BEST SEEN IN THE WALK

The different styles of front and back feet are marked characteristics. In galloping, all of these animals leave the hind tracks ahead of the fore tracks, but they disturb the ground to such an extent that almost no characteristic marks are to be seen.


h
f
(a) Bull Moose
walking
E. T. Seton
36 in. or more
up to 60 in.
h
7. in
5½ in
7 in
fr
6 in.
hind
front

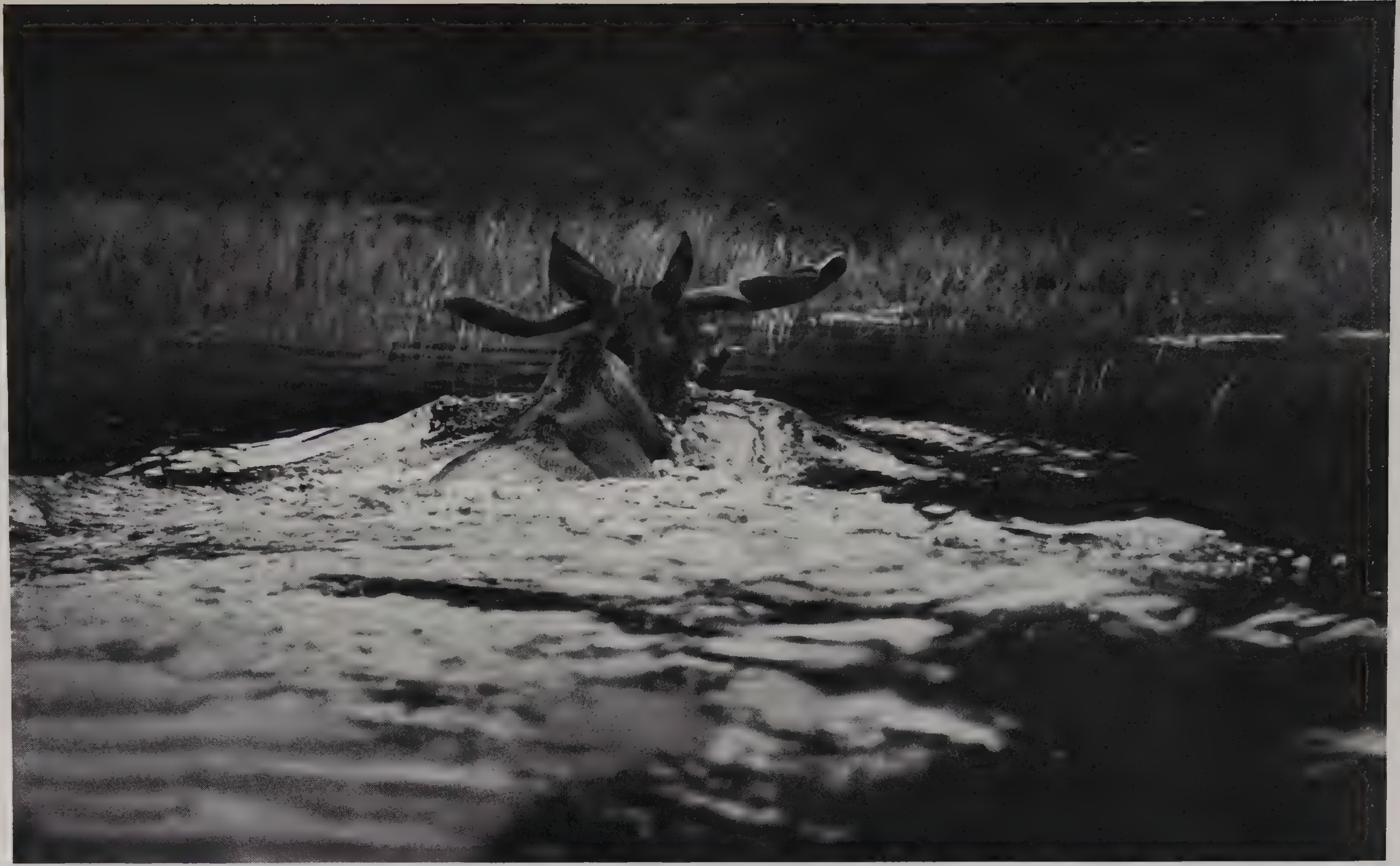
THE TRACK OF A BIG BULL MOOSE WALKING ON HARD GROUND

The great size, the pointed shape, and the long stride usually distinguish it from the track of a domestic cow (see page 246). Ordinarily, the clouts do not show. The dung pellets, however, are important diagnostics. They are cylindrical, about ⅝ inch through and 1¼ inches long. Oftentimes the hind foot is set far ahead of the front foot. The excessive spreading of the hoofs is a strong characteristic.


26 in
or more
Cow Moose
in mud E. T. Seton
5½ in.
9 inches
6 in.

TRACK OF A COW MOOSE WALKING IN THREE OR FOUR INCHES OF MUD

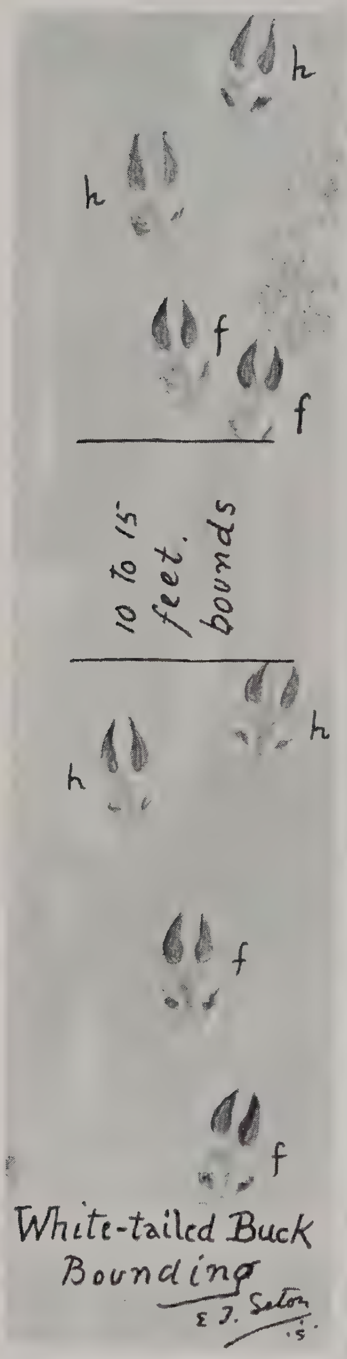
In this the clouts show clearly. Excessive pointedness is not a fixed character. The hoofs of a moose in swamp country are larger and more pointed than those in a rocky country, because less worn. This track was sketched in a land of swamps, so that it is longer and sharper than the average.



Photograph by George Shiras, 3d

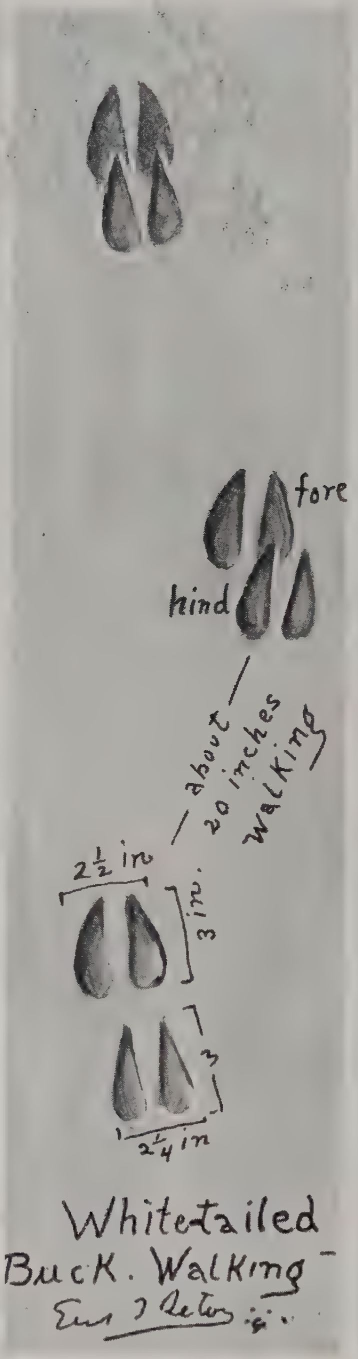
A SWIMMING MOOSE PHOTOGRAPHED BY FLASHLIGHT

The moose is the most powerful of the deer kind now existing, and is a mighty swimmer when alarmed, as shown by the surging water about the animal. The antlers, still in the velvet and only partly grown, were so wide-spreading that they must have reached a remarkable size. This photograph was taken in a small lake in New Brunswick, Canada.


h
h
f
f
10 to 15 feet. bounds
h
h
f
f
White-tailed Buck Bounding
E. T. Seton '15

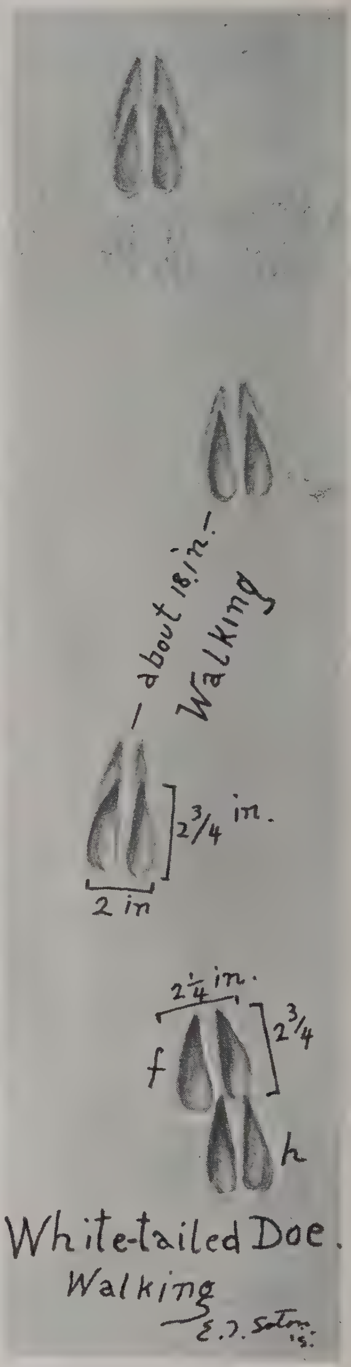
WHITE-TAILED DEER
BOUNDING

In these the clouts are clearly shown. Note the resemblance to the tracks of the moose (see page 220), which differ chiefly in their greater size.


fore
hind
about 20 inches walking
2½ in
3 in.
3
2¼ in
White-tailed Buck. Walking
Ern. T. Seton '15

WHITE-TAILED DEER
WALKING

The track of the white-tail is ideal—a starting point to study all the tracks. Sometimes the hind foot fits on the front track, but sometimes not.


about 18 in. Walking
2¾ in.
2 in
2¼ in.
2¾
f
h
White-tailed Doe. Walking
E. T. Seton '15

WHITE-TAILED DOE
WALKING

This track differs from that of the buck in being smaller, slimmer, and in having the toes pointing forward or inward—rarely outward.

Photograph by Clifton Adams

SUPPER TIME AT THE STATE GAME FARM AT MASON, MICHIGAN

These five-months-old white-tailed fawns were obtained by wardens from State game refuges. When older they will be distributed to other refuges or to public parks. The appearance of the attendant with a bottle and a bucket of warm milk to keep the bottle filled brings a stampede for supper.

certain game preserves of Poland and the Caucasus. Since the beginning of the World War the number of these has been greatly decreased and the species appears close to extinction. The size, dark, shaggy coat, great head, and high arched shoulders of our bison give them a unique individuality among American big game. They once roamed in vast numbers over a broad territory extending from Great Slave Lake, Canada, south to southern New Mexico, and from Pennsylvania and eastern Georgia to Arizona and northern Nevada. It is thus evident that they were at home in the forested country east of the Mississippi River, as well as on the treeless Plains of the West. In the northern part of their range they are larger and darker than elsewhere and form a local geographic race called "wood buffalo."

Originally buffalo were enormously abundant in America, and it has been variously estimated that when the continent was first discovered their numbers were from 30,000,000 to 60,000,000. With the settlement of eastern America, they gradually retreated across the Mississippi River, but continued to exist in great but rapidly diminishing numbers on the Great Plains up to within the last 60 years.

The crossing of their range by the first transcontinental railroad quickly brought the remaining herds to an end. In 1870 there were still about 5,500,000 head on the Plains, but these were so wastefully slaughtered for their hides that in 1895 only about 800 remained. The depletion of the herds was so startling that sportsmen and Nature lovers awoke to the danger of the immediate extermination of these splendid animals; the American Bison Society was organized and the surviving buffalo were saved.

Although the bison has but a single calf, these are so hardy and do so well in fenced preserves, and even in the closer confinement of small parks, that their number has now increased to more than 15,000, mainly in Canada. In the district south of Artillery Lake, northern Canada, a few hundred individuals, remnants of the wild stock of that region, the wood buffalo, survived and were increasing under the wise protection of the Canadian Government. However, within recent years that Government has turned loose with the wood buffalo hundreds of the surplus of its herd of Plains animals from the United States. While this policy has been effective in rapidly increasing the number of bison in a wilderness area, it has obliterated a fine geographic race. The only other American herd still existing on its original ground is that in Yellowstone National Park.

Experiments have been made in crossing buffalo with certain breeds of domestic cattle for the purpose of establishing a new and hardier variety of stock for the Western ranges. These have not proved successful, largely owing to the lack of fertility in the hybrid, which has been called the "cattalo."

Under primitive conditions, buffalo herds numbering millions of animals regularly migrated in spring and fall from one feeding ground to another, often traveling hundreds of miles for this purpose. The herds followed the same routes year after year and made lasting trails, often from two to three feet in depth. Investigation has shown that many of our highways, and even some of our main railway lines, seeking the most convenient grades, followed trails laid down by these early pathfinders. When a great migrating herd was stampeded, the thunder of its countless hoofs shook the earth, and in its flight it rushed like a huge black torrent over the landscape.

Over a great area the buffalo was the most important game animal to the Indians. Several tribes were dependent mainly upon these animals for food and clothing and the entire tribal economy was built about them. The mode of life, customs, and folklore of the Indians all centered about these animals. Their clothing and tepee covers were made of the skins. The tanned skins also served as individual and tribal records of the warrior-hunters, the chronicles being drawn in picture-writing on the smooth surfaces.

The passing of the buffalo on the free sweep of the Western Plains ended forever one of the most picturesque phases of aboriginal life in America.

MUSK OX: Ovibos moschatus, and its subspecies

(For illustration, see Color Plate, page 229)

The musk ox is one of the unique and most interesting of American game animals. In general appearance it suggests a small, odd kind of buffalo, and is, in fact, related to both cattle and sheep. It is a heavily built, round-bodied animal, with short, strong legs, and long, fringelike hair which hangs so low on the sides that it sometimes trails on the snow. The horns—broad, flat, and massive at the base—curve down and out to a sharp point on each side of the head and form very effective weapons for defense.

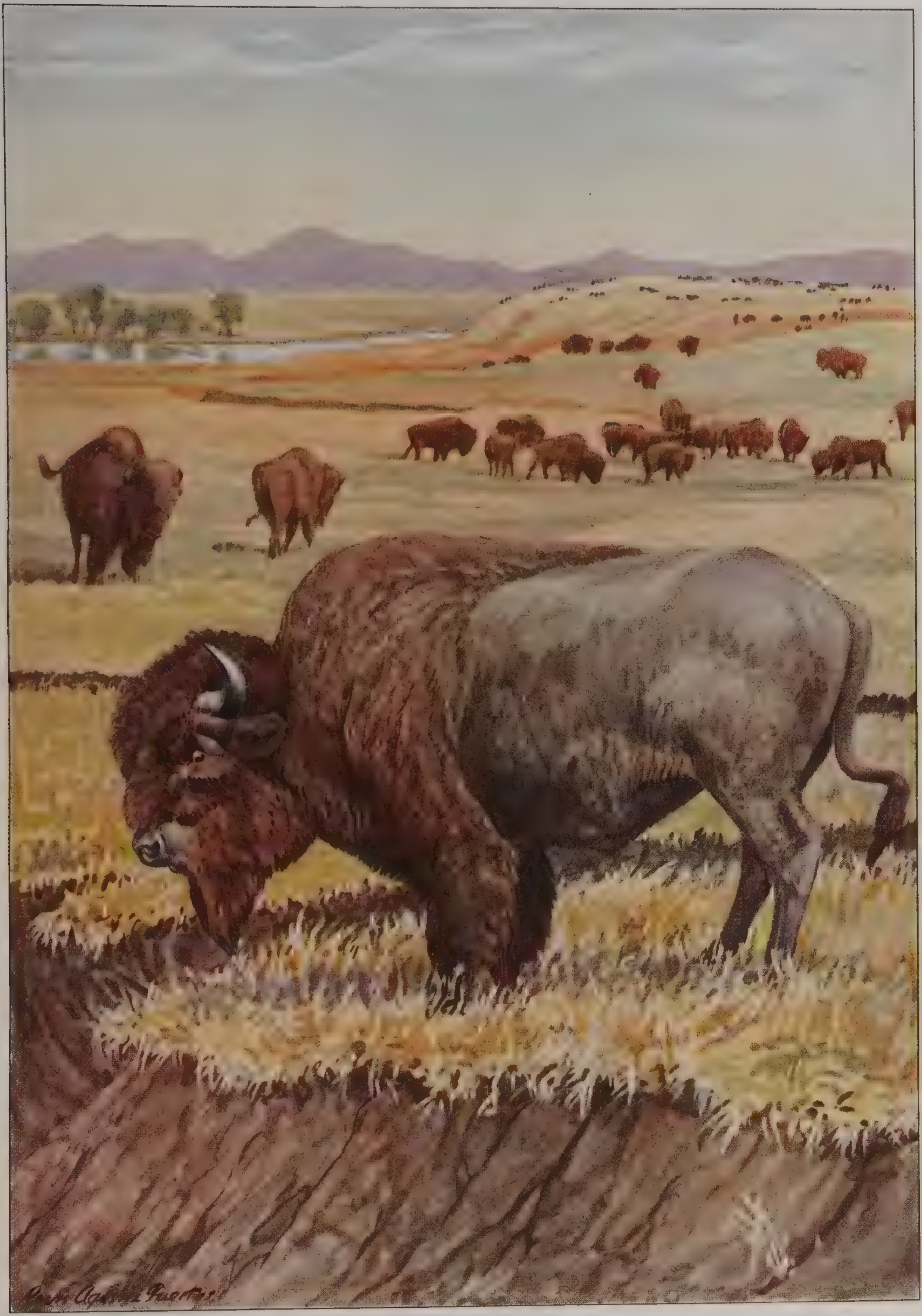
Fossil remains prove that musk oxen ranged widely in northern Europe, Asia, and North America during Pleistocene times, but they have long been confined to Arctic America. Up to within a century they have occupied nearly all of the cheerless wilds north of the limit of trees, from the coast of northern Alaska to that of east Greenland. They appear to have become extinct in northern Alaska within the last 100 years, and their present range east of the Mackenzie River is becoming more and more restricted.

They are now limited to that part of the Barren Lands of Canada lying north and northwest of Hudson Bay and from the Arctic islands northward and eastward to the northern and eastern coast of Greenland. Their range extends to beyond 83 degrees of latitude and covers some of the bleakest and most inhospitable lands of the globe. There a short summer, with weeks of continuous sunshine, permits the growth of a dwarfed and scanty Arctic vegetation; but winter brings a long period of night, continuous, in the northernmost parts, through several months.

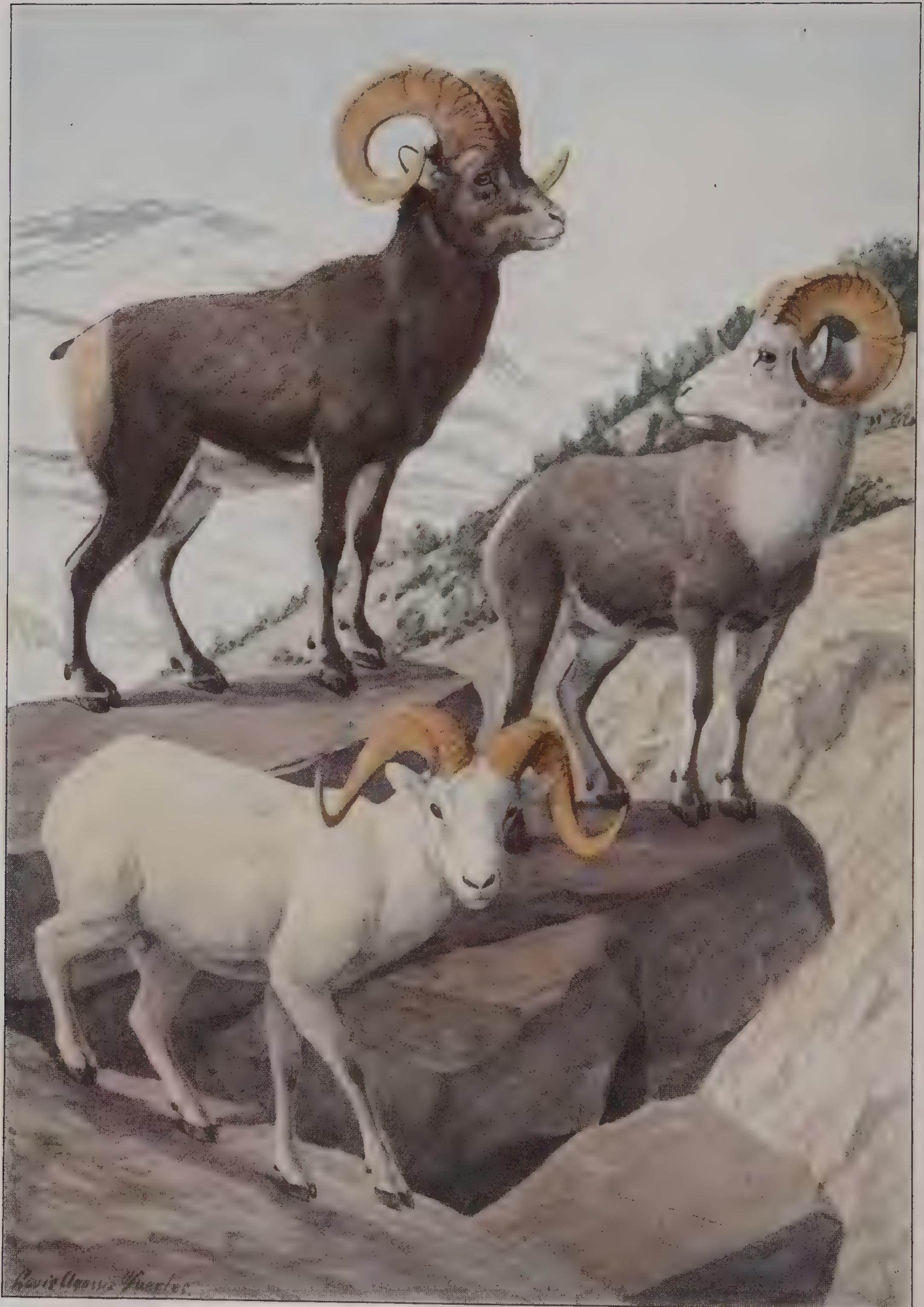
Under such rigorous conditions musk oxen thrive unless hunted by civilized man. They are strongly gregarious, usually traveling in herds of from six to twenty, but herds containing about 100 have been recorded. Their eyesight is not strong, but their sense of smell is good, and when danger is suspected they dash away with great celerity for such heavily formed animals. If rocky ground is near, they seek refuge in it and ascend steep, broken slopes with astonishing agility.

When brought to bay, the herd forms a circle about the calves and, with heads out, presents to the enemy an unbroken front of sharp horns. So long as the circle remains unbroken, such a defense is extremely effective against both dogs and wolves. The only natural enemies of musk oxen are wolves, and against these and the primitive weapons of the Eskimos they hold their own very well.

When the Greely Expedition landed at Lady Franklin Bay in 1881, musk oxen were encountered and killed practically on the site where winter quarters were established. Since then several exploring and hunting parties have taken heavy toll from the herds of that region. Some accounts of the wholesale killings do not make pleasant reading for one who desires the


Louis Agassiz Fuertes

AMERICAN BISON, or BUFFALO
Bison bison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DALL (1), STONE (2), and FANNIN (3) MOUNTAIN SHEEP
Ovis dalli, *Ovis dalli stonei*, and *Ovis fannini*

perpetuation of our native species. Fortunately for the musk oxen, the adventurers of these northern quests are few and far between, so that on departing they leave the game animals in their vast solitudes to recuperate from these onslaughts.

Musk oxen have but a single young, so that between depredations of wolves and overkilling by white and native hunters these animals face the very real danger of extermination threatening so many other game animals in the Far North. For this reason, it is hoped that sportsmen who visit these remote game fields will restrain a desire for taking large bags.

The active interest the Canadian Government is now taking in the protection and perpetuation of musk oxen within its territory is likely to enable them to survive far longer than would otherwise have been possible. Another favorable influence for their prolonged future is the introduction, in 1930, of a herd of 34 young animals into Alaska by the U. S. Department of Agriculture. This is done with a desire to restock some of their former range there.

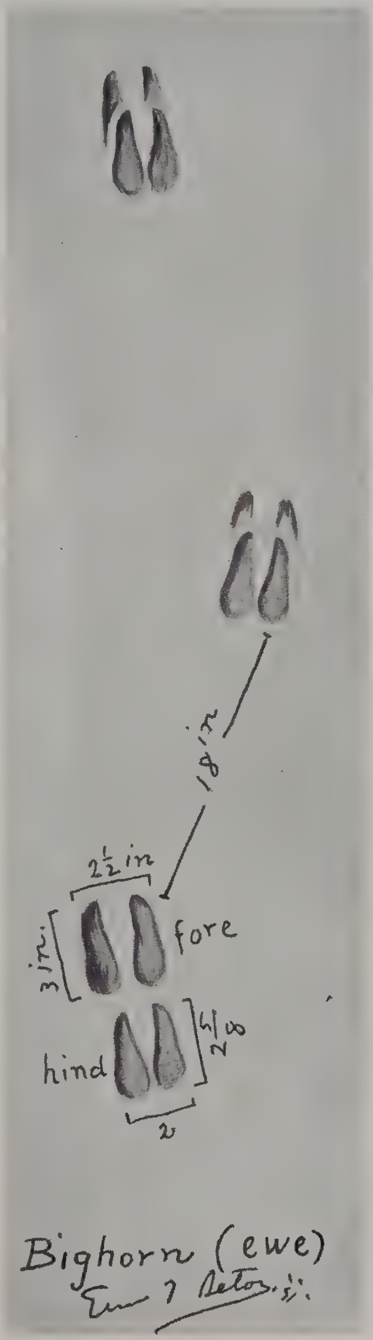
ROCKY MOUNTAIN SHEEP: **Ovis canadensis** and its relatives

(*For illustration, see Color Plate, page* 215)

In the New World mountain sheep occur only in North America, where there are two species, with numerous geographic races. Among these the sheep inhabiting the main Rocky Mountain region is best known. It is a heavier animal than its northern relatives of the Stikine country and Alaska, with larger and more massively proportioned horns. It occupies the main range from Peace River and Lake Babine, in British Columbia, southward to Chihuahua and Lower California, Mexico. Within this range several subspecies have developed.

The usual conception of wild sheep as inhabitants of the cold, clear, upper world at timberline and above is justified in the case of the typical Rocky Mountain sheep. In early spring its one or two young are born amid these rugged elevations, where it remains until the heavy winter snows drive it down, sometimes through the open timber to the foothills. That wild sheep thrive equally well under very different conditions, however, is shown by their abundance on the treeless mountains of our southwestern deserts and in Mexico among cacti, yuccas, and other thorny vegetation, where water is extremely scarce and summer temperatures rise high above 100° Fahrenheit in the shade.

The Rocky Mountain sheep, like other species, appears to feed on nearly every plant growing within its domain. In spring many lambs are killed by bald and golden eagles, and in winter, when driven down to lower levels by snow, it becomes easy prey for mountain lions, wolves, and coyotes. Continuous hunting has caused this sheep to disappear from many of its former haunts and it is decreasing over most of its range. When effective protection is un-



TRACKS OF THE ROCKY MOUNTAIN SHEEP

A bighorn's track is similar to that of deer, but the toes are finished off more squarely and the hollow in the outer edge of each hoof is a strong characteristic. Sometimes the tracks are in correct register. The clouts rarely show. The track is that of a ewe; the ram's is similar, but larger.

dertaken in time, however, as in Colorado, the range is readily restocked.

The sure-footedness with which a band of these sheep will dash in full flight up or down seemingly impossible slopes, where a misstep would mean death, is amazing. Even the old rams, with massive sets of horns, bound from point to point up a steep rock slope with marvelous grace and agility. Mountain sheep living among the rugged summits of high ranges possess the courage and prowess of skillful mountaineers, so admired by all, and the mere sight of one of these animals in its native haunts is an adventure achieved by few.

No other big-game animal carries with it the romantic glamour which surrounds this inhabitant of the cold, clear, upper world. Big-game hunters prize above all others their mountain-sheep trophies, which form vivid reminders of glorious days amid the most inspiring surroundings and bear witness to their supreme prowess in the chase.

DALL SHEEP: Ovis dalli

(*For illustration, see Color Plate, page* 226)

The only variation in the pure-white coat of the Dall sheep is a mixture of a few black hairs on the rump, sometimes becoming plentiful enough to form a blackish spot on the tail and a light brownish stain over the entire body, due to the slight discoloration at the tips of the hairs from contact with the earth in their bedding-down places. Their horns are usually dull amber yellow and are notable for their slender proportions and the grace of their sweeping coils, which sometimes curve close to the head and again spread in a wide, open spiral.

As their white coats indicate, the Dall sheep are the northernmost of their kind in America. Their home lies mainly in Alaska, where they were formerly abundant in many mountain ranges, from those bordering the Arctic coast south through the interior to the cliffs on Kenai Peninsula, but are now scarce or gone from some mountains. To the eastward they are numerous across the border in much of Yukon Territory, nearly to the Mackenzie River. Their haunts lie amid a wilderness of peaks and ridges, marked in summer with scattered glaciers and banks of perpetual snow and in winter exposed to all the rigors of a severe Arctic climate. They are extraordinarily numerous in some districts, as among the outlying ranges about the base of Mount McKinley.

In their high, bleak homes these sheep have little to fear from natural enemies, although the great Canada lynx, the wolf, the wolverine, and the golden eagle, as overlords of the range, take occasional toll from their numbers. Their one devastating enemy is man, with his modern high-powered rifle. Even so long ago as the summer of 1881, I saw hundreds of their skins among the Eskimos at Point Barrow, taken that spring with the use of Winchester rifles among the mountains lying inland from the Arctic coast. Of late years the advent of miners and the establishment of mining camps and towns greatly increased the demand for meat, and this resulted in the killing of thousands of these sheep. Large numbers of these splendid animals have also been killed to serve as winter and summer dog food.

The advent of thousands of men engaged in the construction of the Government railroad which passes through the Mount McKinley region made imminent the extermination of mountain sheep, as well as the moose and caribou, in this great area of the finest big-game country left under our control. Fortunately, through the initiative of Charles Sheldon and others, Congress became interested and the Mount McKinley National Park was established, thus insuring the future of the game there.

Properly conserved, the game animals of Alaska will continue indefinitely as one of its richest resources, but heedless wastefulness may destroy them forever. All sportsmen and other lovers of wild life should interest themselves in an effort to safeguard the future of Alaskan game animals before it is too late; for, under the severe climatic conditions prevailing, the restocking of exhausted game fields in that region will be extremely difficult, if not practically impossible.

STONE SHEEP: Ovis dalli stonei

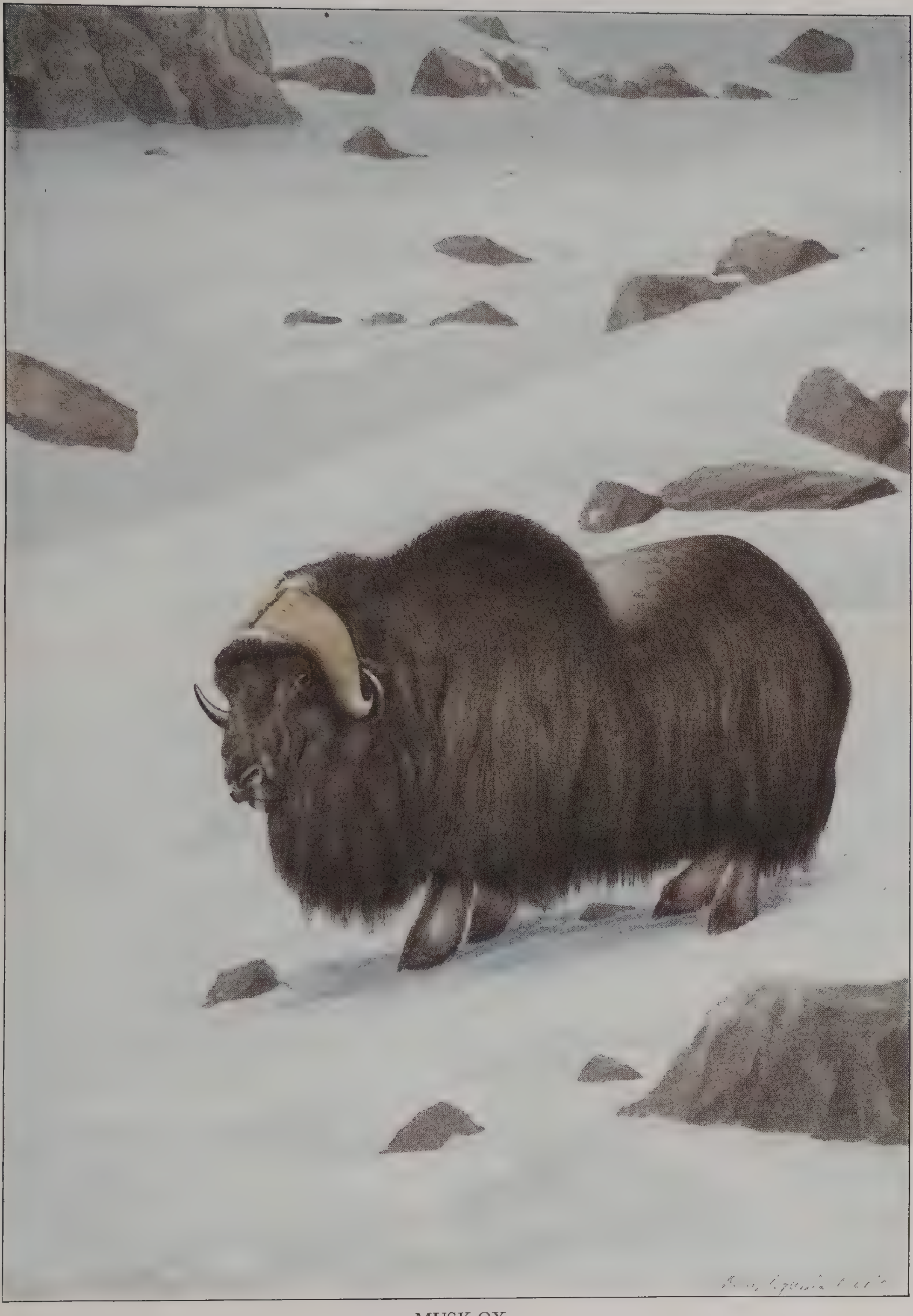
(*For illustration, see Color Plate, page* 226)

The dark, iron-gray color of the body of *Ovis stonei* has caused it to be named "black mountain sheep." Despite its dark color, the Stone sheep is, with little doubt, a geographic race of the pure-white Dall sheep of Alaska. It has the same slender, gracefully coiled horns, frequently amber-colored and extended in a widely spread spiral.

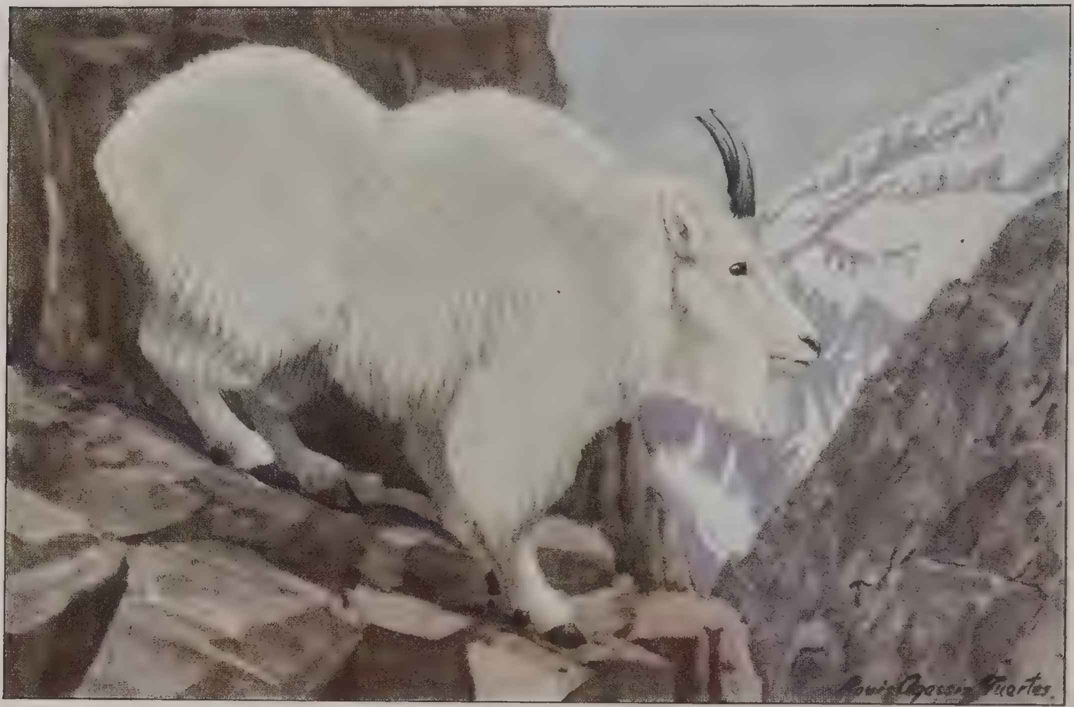
Its range lies in northern British Columbia, especially about the upper Stikine River and its tributaries; thence it extends easterly to Laurier Pass, in the Rocky Mountains, north of Peace River. Formerly, it extended south perhaps to Babine Lake. Unfortunately it appears to have become extinct in the southern border of its range, so that its real relationship with the Rocky Mountain sheep farther south may never be determined.

The sheep occupying the mountains between the home of typical *stonei* and that of *dalli* in northwestern British Columbia and southeastern Yukon Territory are characterized by having white heads, with bodies of a varying shade of iron-gray, thus showing evident intergradation on a great scale between the white northern sheep and the "black" sheep of the Stikine. These intermediate animals have been called the Fannin, or saddle-backed, sheep, *Ovis fannini.* Hunters report a considerable mingling of entirely white sheep among flocks of these intergrading animals, and occasionally white individuals are seen even in flocks of the typical dark sheep of the Stikine country.

Like the white Alaskan sheep, the Stone sheep exists in great abundance in many parts of its range, especially east of Dease Lake. It usually ranges in flocks, those made up of ewes and young rams often containing a considerable number. The old bucks, except in



MUSK OX
Ovibos moschatus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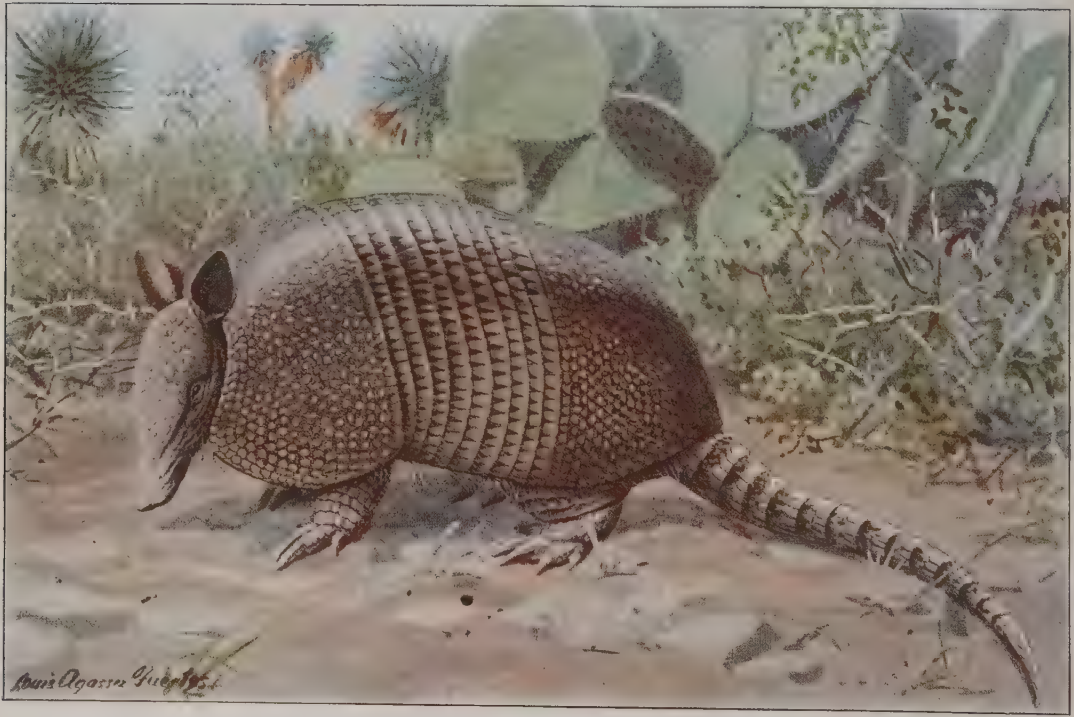
ROCKY MOUNTAIN GOAT
Oreamnos montanus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TEXAS NINE-BANDED ARMADILLO
Dasypus novemcinctus texanus

fall, keep by themselves in smaller bands in separate parts of the range. The Stone sheep lives in one of the most notable big-game fields of the continent. Its home above the timber-line is shared with the mountain goat and in the lower open slopes with the caribou, while within the adjacent forests wander the moose and two or more species of bear.

Owing to its frequenting remote and sparsely inhabited country, it continues to exist in large numbers; but if its range becomes more accessible, only the most stringent protection can save this splendid animal from the extermination already accomplished on the southern border of its range.

ROCKY MOUNTAIN GOAT: **Oreamnos montanus** and its subspecies

(For illustration, see Color Plate, page 230)

This is one of the most characteristic, but least graceful in form and action, of our big-game animals. It is distinguished by a long, ungainly head ornamented with small black horns, a heavy body humped at the shoulders like a buffalo's, and a coat of shaggy white hair.

The range of these inhabitants of the cliffs extends from the head of Cook Inlet, Alaska, easterly and southerly through the mountains to Montana and Washington. Unlike mountain sheep, the goats do not appear to dislike the fogs and saline winds from the sea, and at various points along the coast of British Columbia and Alaska they range down precipitous slopes nearly to the shore.

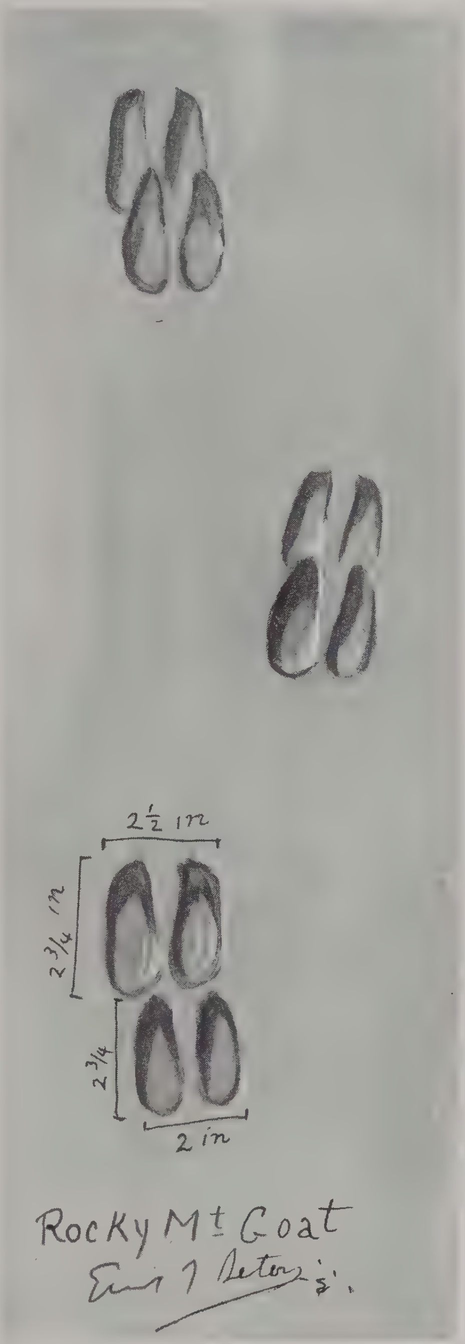
They are much more closely confined to rugged slopes and rocky ledges than the mountain sheep, which in winter commonly descend through the foothills to the border of the plains. Through summer and winter, goats find sufficient food in the scanty vegetation growing among the rocks, and their heavy coats of hair protect them from the fiercest winter storms.

Because of their small horns and unpalatable flesh they are less sought after by hunters than mountain sheep, and thus continue to exist in many accessible places where otherwise they would long since have been exterminated.

Although marvelously sure-footed and fearless in traversing the faces of high, precipitous slopes, goats lack the springy grace and vivacity of mountain sheep and move with comparative deliberation.

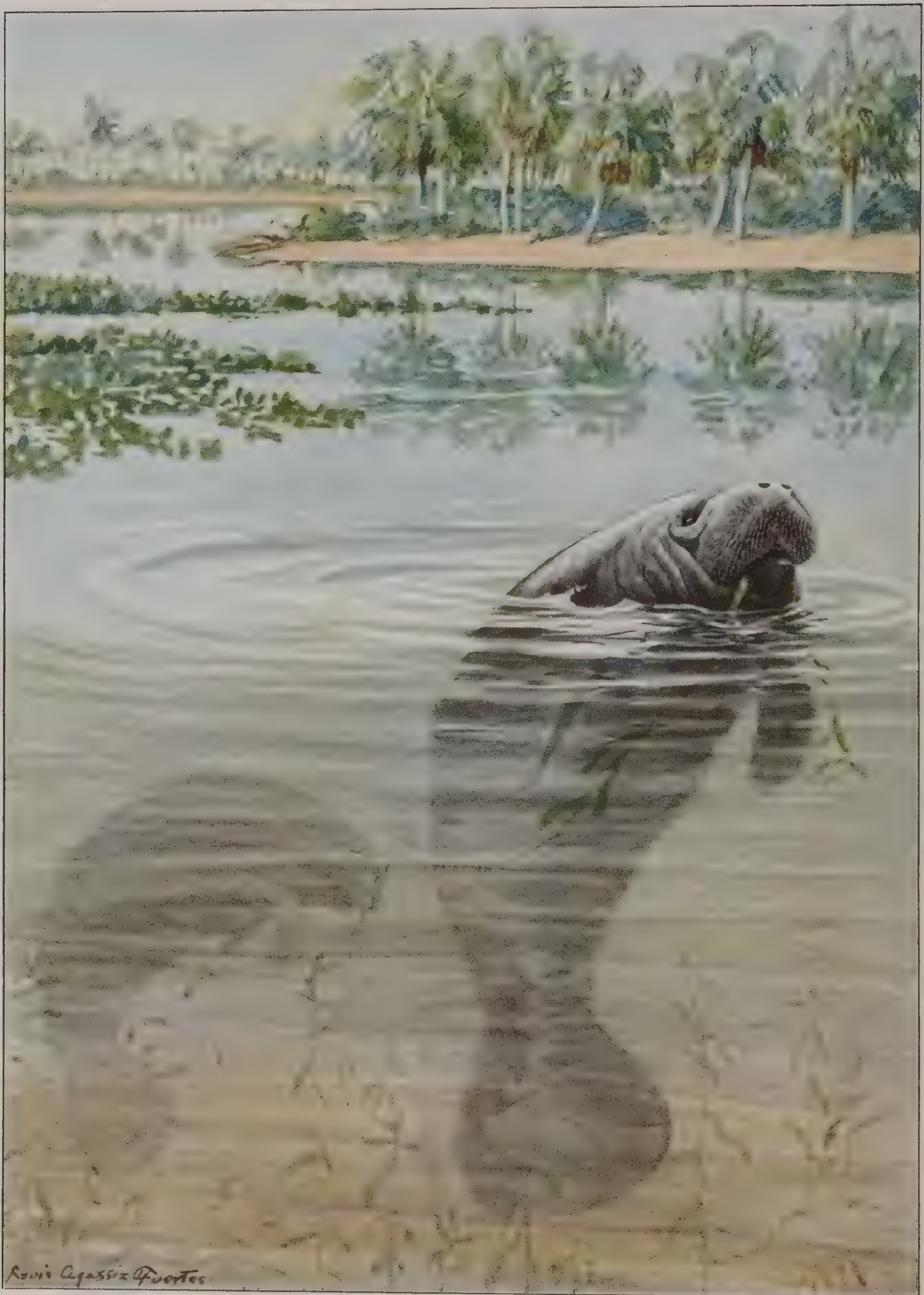
Their presence lends interest to many otherwise grim and forbidding ranges where, amid a wilderness of glacier-carved escarpments, they endure the winter gales which for days at a time roar about their cliffs and send snow banners streaming from the jagged summits.

Mountain goats have few natural enemies. The golden and bald eagles now and then take toll among their kids, but the lynx and mountain lion, their four-footed foes, do not prey upon them to any considerable extent. Through overhunting they have vanished from some of their former haunts, but still hold their own in many places.



ROCKY MOUNTAIN GOAT TRACKS

Kinship with sheep and antelope is reflected in the track of the goat. Its heel-pads are so large and rubberlike that the track is rarely so sharp as here shown. Mountain goats are reputed to show at times a stupid obstinacy when encountered on a narrow ledge, even disputing the right of way with the hunter.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FLORIDA MANATEE
Trichechus latirostris

CHAPTER XIV

Armadillos, Manatees, Right Whales, Sperm Whales, Killer Whales, and White Whale, or Beluga

THE Order of *Xenarthra* contains four families of strangely dissimilar animals, each of which is also very different in structure and habits from all other mammals. They are peculiar to North and South America, but only one ranges within our borders. The others are mainly within the Tropics, especially in Central and South America, with their center of abundance in the southern continent.

Armadillos (Family *Dasypodidæ*) are the only mammals having the top of the head, the back, and sides covered with a bony armor. This serves as a very imperfect protection from some of their smaller enemies. They occur only in North and South America, but are by far more numerous in the south. Fossil remains show that South America in the past had great numbers of these animals, some attaining gigantic size. In those times armadillos, great and small, formed an important element in the mammal fauna of that region.

At present the nine-banded armadillo, Genus *Dasypus,* which ranges from Argentina to Texas, appears to be one of the larger surviving species. It is characterized by the bony armor on the middle of the back being divided into nine rather narrow transverse bands connected by a tough, flexible ligament which enables the animal to roll up into a round ball, head and tail along the abdomen, when attacked.

This animal has the greatest range of any member of the family and has developed numerous geographic subspecies.

SEA COWS HAUNT TROPICAL WATERS

The strange aquatic mammals of the Order *Sirenia,* known as sea cows, dugongs, and manatees, contains only a limited number of families made up of widely separated or isolated species. With the exception of Steller's sea cow, which was exterminated by the Russian sailors soon after its discovery on Copper and Bering Islands, nearly two centuries ago, the various members of the group live in tropical or subtropical waters of eastern North and South America, Africa, Asia, and Australasia. Steller's sea cow lived in cold waters of the North Pacific Ocean. Those living now are all thoroughly aquatic and subsist on vegetation growing in, or close to, the margin of shallow, fresh water in the lower courses of rivers, shallow sheltered bays and lagoons, along sea coasts, or on sea weed (*Algæ*). The skins of all the members of the order are hairless, as in the whales, to which they have no near relationship.

The manatees, Family *Trichechidæ,* occupy the warmer parts of the African and American shores of the Atlantic. They have large, bifid, flexible lips that seize and push food into the mouth, large paddle-shaped front flippers, and a broad, horizontally flattened tail with an oblong, rounded outline.

The characters of the family are those also of the single Genus *Trichechus,* which contains three species very similar in general appearance and habits. Only one of them enters our limits.

WHALES ARE LARGEST OF THE MAMMALS

All members of the Order *Cetacea,* which includes whales, dolphins, and porpoises, have hairless, leathery skin and are fish-like in their general shape, but their tails are flattened horizontally.

Although so similar in general shape, members of this order vary greatly in structural details, size, and habits. Some of the smaller ones are only a few feet in length and are remarkable for their swiftness and agility in the water. The larger ones exceed 100 feet in length, being the greatest of mammals. As might be expected from their bulk, these great animals move much more deliberately than their small relatives.

Whales and their kind frequent all the seas and a few of the smaller ones go far up great rivers. They are divided into two great groups. One possesses teeth, used in capturing the fish or other large living prey they feed upon. The other has series of whalebone, or baleen, plates with fringed borders, hanging from the roofs of their mouths, through which they strain the sea water which they take in in great quantities as they swim. By letting it flow from the sides, they strain out enormous numbers of small invertebrates upon which they subsist.

They all bear a single young, which at first is nourished by milk from a pair of glands and teats located far back on the abdomen.

The whalebone whales, Family *Balænidæ,* occur in the Arctic and Antarctic seas, where they are circumpolar in distribution. They frequent the broken borders of the ice pack and the vicinity of the adjacent continents. Several genera are included in the family.

Right, or bowhead, whales, of the Genus *Balæna,* are the great whales of Arctic and Antarctic waters which for many decades were the basis for a great whaling industry. These whales have huge mouths, from the roofs of which hang hundreds of narrow sheets of baleen. These sheets from a single whale were at one time worth from $4,000 to $6,000, in addition to the value of the oil the animal yielded.

The sperm whale, Family *Physeteridæ,* contains several genera differing much in size and appearance, but all characterized by having functional teeth, only in the lower jaws, which fit into sockets in the "gum" of the upper jaw. It frequents both the Atlantic and Pacific Oceans.

The sperm whale, belonging to the Genus *Physeter,* is one of the most notable species of whales. It is of enormous size and has a huge square-fronted head. The value of its oil made it a rich prize in the heyday of the whaling industry and it shared with the right whale the interest of the whaling fleets.

The large and extremely varied family of *Delphinidæ* includes most of the smaller members of the order of whales, rarely exceeding 20 feet in length. They practically all have a row of many teeth in the upper and lower jaws and many have a dorsal fin.

Nearly everyone has seen one or more of these little whales, for they commonly travel, or hunt, in schools of from a few individuals up to several hundred, mainly frequenting the vicinity of coasts in all parts of the world. Many frequent bays, coastal lagoons, and mouths of rivers. One species lives far up the Amazon and a few others sometimes go hundreds of miles up the lower courses of other large rivers.

All these whales are predatory, subsisting largely on fish or other small aquatic life, but the killers attack seals or even large whales.

Along some coasts many people hunt porpoises for their oil and skins, which have a good commercial value.

Killer whales, Genus *Orcinus,* frequent all seas from the border of the Arctic ice pack to the coast of Antarctica. They attain an extreme length of only 30 feet, but are the most ferocious of sea mammals.

Killers are black, with large white areas on the sides and below. Their most distinguishing character, however, is the long curved back fin, which, projecting above the water as they travel the ocean in search of prey, signals their presence at a considerable distance. It is doubtful if more than a single species exists, but this question still remains unsettled.

The white whale, or beluga, Genus *Delphinapterus,* contains only a single species, a small, milk-white whale which has no back fin and reaches an extreme length of from 15 to 18 feet. It is circumpolar in distribution, frequenting the shores of the Arctic Ocean and ranging southward to the borders of the northern Atlantic and Pacific Oceans.

TEXAS NINE-BANDED ARMADILLO: **Dasypus novemcinctus texanus** and its relatives

(*For illustration, see Color Plate, page 230*)

Armadillos are distinguished from other mammals by having their early, or quite hairless, skin developed into a bony armor covering the upperparts of the head and body and all of the tail. They lack teeth in the front of both upper and lower jaws, and are members of the group of toothless animals which includes the anteaters. The insects they feed on are licked up by the sticky surface of their extensile tongues.

In the remote past many species of armadillos, some of gigantic size, roamed the plains of South America, and a number of small genera and species still exist there. These animals are peculiar to America and have their center of abundance in the southern continent.

The nine-banded species ranges over an enormous territory and is subdivided into a number of geographic races, living from southern Texas through Mexico and Central America to

Argentina. In Mexico its vertical distribution extends from sea level up to an altitude of about 10,000 feet on the mountains of the interior. Like the hog-nosed skunk, it no doubt originated as a member of the South American fauna and has spread northward to its present limits. It is one of the larger of the living representatives of this curious group of animals and reaches a weight of from 12 to 15 pounds.

As might be surmised from its appearance, the armadillo is a stupid animal, living a monotonous life of restricted activities. Its sight and hearing are poor, and the armored skin gives it a stiff-legged gait and immobile body. From these characteristics, combined with the small head hung low on a short neck, it has in life an odd resemblance in both form and motion to a small pig; it jogs along in its trails or from one feeding place to another with the same little stiff trotting gait and self-centered air. If alarmed it will break into a clumsy gallop, but moves so slowly that it may be overtaken by a man on foot. So poor is its eyesight that a person may approach openly within about 30 yards before being noticed.

When alarmed the armadillo immediately runs to the shelter of its burrow, but may easily be caught in one's hands, especially if intercepted on the way to its den. When caught it will struggle to escape, and while it may coil up in a ball in the presence of a dog or other mammal foe, I never saw one try to protect itself in this way. While presumably serving for protective purposes, the armor is flexible on the sides of the body, and I have found the remains of many armadillos where they had been killed and eaten by coyotes or other predatory beasts. The armor would no doubt be sufficient protection to enable them to escape to cover from the attack of birds of prey. They are mainly nocturnal animals, but are frequently seen abroad by day and in some places appear to be out equally by day or night.

This armadillo lives by preference amid the cover afforded by forests, brushy jungle, tall grass, or other vegetation. In the midst of such shelter it usually digs its own burrow a few yards deep in a bank or hill slope, beneath a stump, under the roots of a tree, or a rock, or even on level ground. It will also occupy small caves in limestone rock. At times it shows a piglike fondness for a mud bath, and the prints of its armor may be found where it has wallowed in miry spots.

Well-beaten and conspicuous trails lead from the burrows often for half a mile or more, frequently branching through the thickets in various directions. Armadillo burrows sometimes accommodate strange neighbors, as was shown by one in Texas which was dug out. In addition to containing the owner in his den at the end, it was found to be occupied by a four-foot rattlesnake and a half-grown cottontail rabbit, each in a side chamber of its own.

The food of the armadillo consists almost entirely of many species of insects, among which ants appear to predominate. When searching for food the animals become so intent that they may be cautiously approached and closely observed or captured by hand. They root about among fallen leaves and other loose vegetation and soft earth, now and then digging up some hidden grub or beetle. At night they visit newly plowed fields in their haunts, rooting in the mellow earth. They are accused of digging up plants in gardens during their nocturnal wanderings, and in Texas have been charged with robbing hens' nests of eggs, and of reducing the supply of wild turkeys and quail by breaking up the nests, all of which needs confirmation. Their method of feeding appears to vary considerably, as they have been seen rising on their hind legs to secure small caterpillars infesting large weeds.

The insect food eaten by the nine-banded armadillo in Texas, as known from examination of stomach contents, covers a wide range of insect and other small life, including many species of grasshoppers, crickets, roaches, caterpillars, beetles, ants, spiders, centipedes, and earthworms. As the list includes also wireworms and other noxious species, these inoffensive animals deserve thorough protection as a most useful aid to the farmer.

Some time from February to April each year, litters of from four to eight young are born. They have their eyes open at birth, and the armor is soft and flexible like fine leather. The hardening of the skin into a bony armor is progressive, continuing until after the animal fully completes its growth. As soon as the young are able to travel they trot along with the old one during her foraging trips.

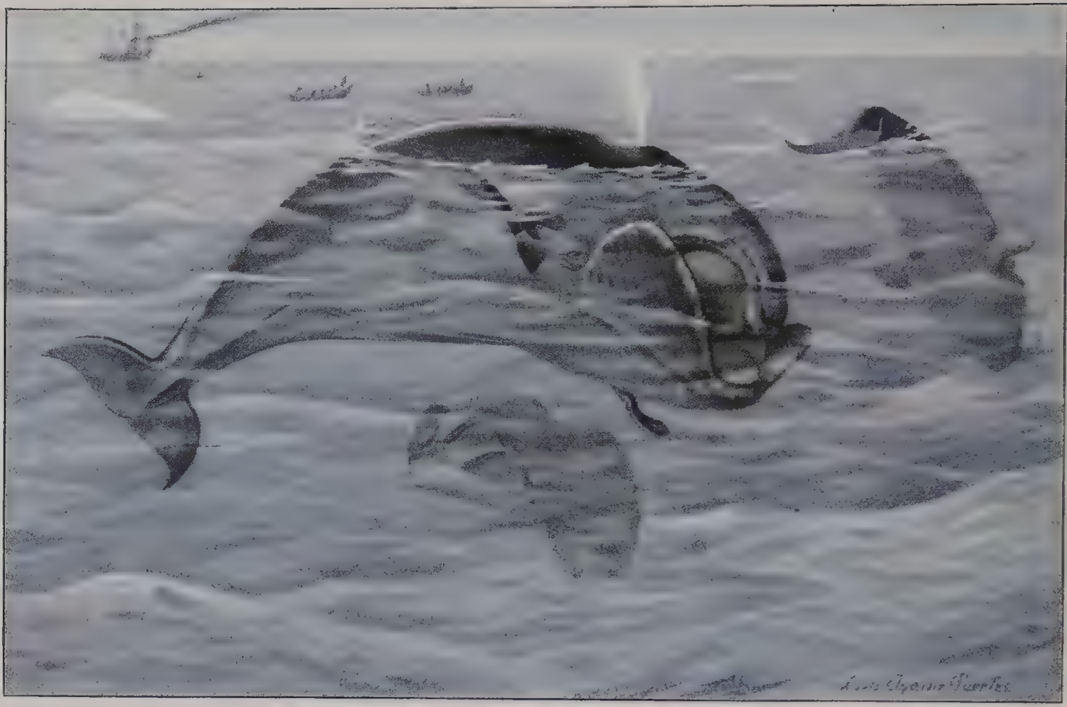
Early one afternoon, when riding along a trail in the heavy forest of southern Oaxaca, accompanied by an Indian boy and a pack of dogs, I suddenly came upon an old armadillo and eight young about two-thirds grown. They had heard our approach and stood motionless in a compact little group half hidden in the grass. I had barely time to stop my horse when the dogs spied them and made a rush. The armadillos darted into the undergrowth in every direction like a litter of pigs, and, with the exception of two caught by the dogs, gained safe refuge in their burrow. This we found dug in the level ground about 50 yards from where we encountered them.

The Maya Indians of the Peninsula of Yucatan have a legend that the black-headed vulture *(Catharista atrata)* in old age changes into an armadillo. The tale runs, that when a vulture becomes very, very old it notifies its companions that the time has come and alights before a hole in the ground that resembles the den of an armadillo. The other vultures bring food and the old one remains there for a long time. Its wings disappear, the feathers are lost, and when the change is complete the newly created armadillo enters the hole and begins its new life. If skepticism is expressed as to this metamorphosis, the Indians point out as proof of the legend the similarity between the appearance of the bald pate of the vulture and that of the armadillo.

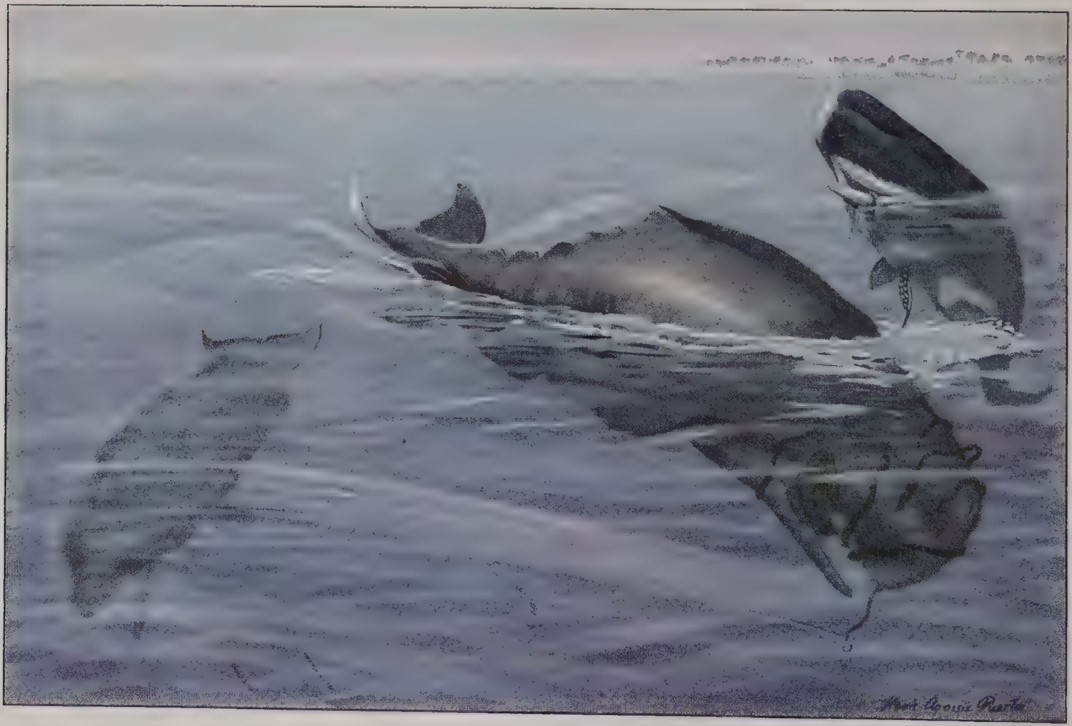
FLORIDA MANATEE: Trichechus latirostris

(For illustration, see Color Plate, page 232)

The manatees, or manatis, are strange aquatic mammals, with seallike heads and whalelike


Louis Agassiz Fuertes

GREENLAND RIGHT WHALE, or BOWHEAD
Balæna mysticetus


Louis Agassiz Fuertes

SPERM WHALE, or CACHALOT
Physeter catodon

bodies. Compared with whales, their flippers are more flexible at the joints, and thus can be used much more freely. They have very small eyes, and a heavy upper lip deeply cleft in the middle and forming a thick lobe on each side. The skin is hairless and covered with fine wrinkles.

These animals inhabit the rivers entering the sea and shallow coastal lagoons on both sides of the Atlantic, in tropical parts of West Africa and of eastern North and South America. The South American species ascends the Amazon and its tributaries well up toward their headwaters.

The Florida manatee regularly frequents the coast from eastern Florida to Mexico, Central America, and the West Indies, in summer sometimes straying as far north as the coast of Virginia.

This species attains an extreme length of more than 15 feet and a weight of more than 1,500 pounds, but the average size is much less. A large specimen exhibited alive at New Orleans the winter of 1912 weighed 1,310 pounds and is reported to have eaten daily from 60 to 100 pounds of grass. One captured near Point Isabel, Texas, measured a few inches more than 15 feet in length.

Manatees were formerly plentiful in the Indian River and elsewhere along the Florida coast, but were shot and netted to the verge of extermination. They were killed not only for amusement by thoughtless sportsmen, but many were killed by residents for their flesh, which was salted down like beef for future use. The flesh is said to be well flavored and not unlike beef.

The imminent danger of the extermination of these curious animals and their evident value for the interest they lend the coastal waters of the State led to the passage of protective laws with a penalty of $500. As a result of this, for a time manatees increased rapidly. In more recent years they have become less numerous.

A correspondent, writing on June 20, 1916, from Ponce Park, on Indian River, says that at this season scarcely an hour in the day passes but that from one to half a dozen may be seen in front of his house. He adds that one with a "calf" about three feet long keeps about his dock all the time. In this vicinity manatees appear to be migratory, leaving about the first of December and returning in early spring, the first one noted in 1916 appearing on March 26. They are extremely susceptible to cold, as was demonstrated by the number which perished in Indian River near Micco, February 12, 1895, when the temperature fell to 20° Fahrenheit. They are known to winter in Biscayne Bay and elsewhere in southern Florida.

Within a few weeks after the manatees return to the vicinity of Ponce Park the young are born. Just before this the females are said to seek the protection of a dock, crib, or bridge, possibly in order that the newborn young may be safer from the sharks and sawfish which abound in these waters. Usually there is only one calf, which is about 30 inches long, but sometimes the mother is seen accompanied by two. During this season the females are scattered and, with their young, keep in comparatively shoal water near the shore, and not infrequently lie in shallow pools with half their bodies exposed. Later in the season they gather in herds and often 15 to 20 may be seen close together. At such times they roll about and make a great turmoil in the water. The Mexicans on the coast of southern Vera Cruz described to me similar summer gatherings of manatees in small lagoons and claimed they were there for the purpose of mating.

In fall, near Ponce Park, the larger animals, probably the old males, separate from the herds and roam about singly. At this time they often make a peculiar noise like a loud snort, which may be heard for half a mile or more.

The Florida manatees are extremely mild and inoffensive animals, seeming never to fight one another or to show aggressiveness of any kind. When not molested they are very gentle and will feed close about a boat or dock regardless of the presence of people, but they become alarmed by any sudden noise. In captivity they soon learn to eat from their captor's hands.

Manatees are sluggish, stupid animals, without other defense than their size. They are not rapid swimmers and are among the extremely few herbivorous aquatic mammals. Unlike seals, whales, and their allies, which feed upon some form of animal life, manatees feed on the lush grasses and other vegetation springing from the oozy bottom of the waters they frequent. When feeding on the bottom they use their flippers to help move slowly about. In places along the Indian River they are reported to approach the shore and, with head and shoulders out of water, to feed on heavy grasslike plants hanging from the bank.

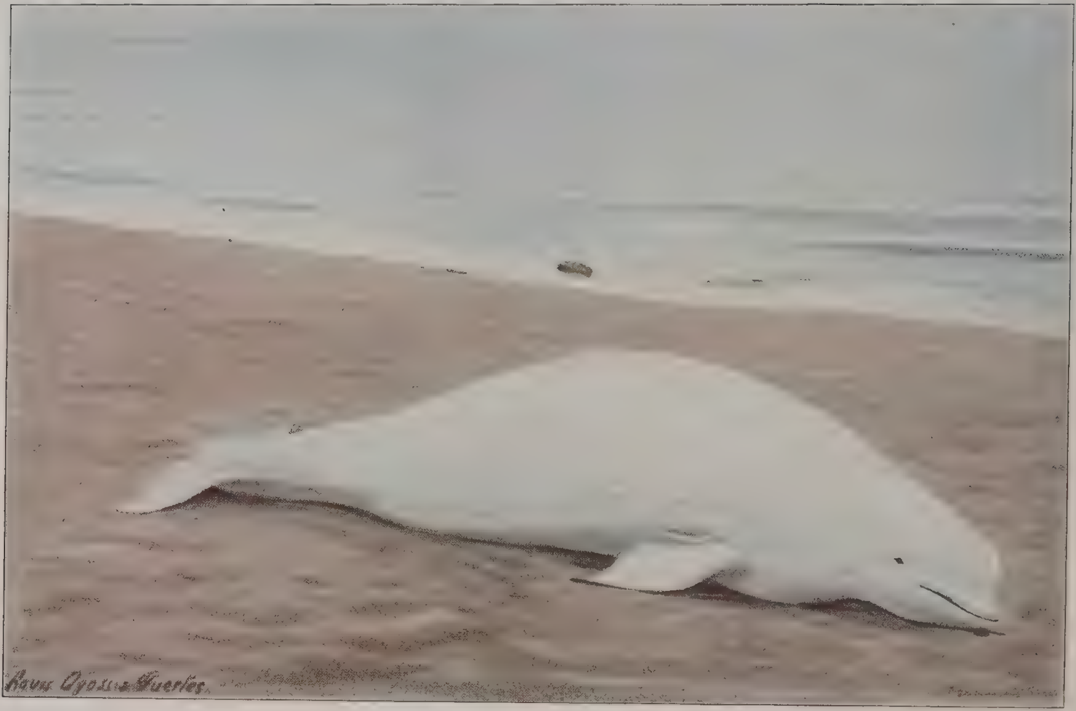
While they are feeding, the heavy, bilobed upper lips work freely and are sufficiently prehensile to seize the grass, or other plant food, between the lobes and thrust it back into the mouth. The ends of the flippers are sometimes used to help convey food to the mouth, like huge hands in thumbless mittens.

When suckling her young the manatee rises to the surface, her head and shoulders out of the water, and with her flippers holds the nursling partly clasped to her breast. This semihuman attitude, together with the rounded head and fishlike tail, may have furnished the basis on which the ancients built their legends of the mermaids.

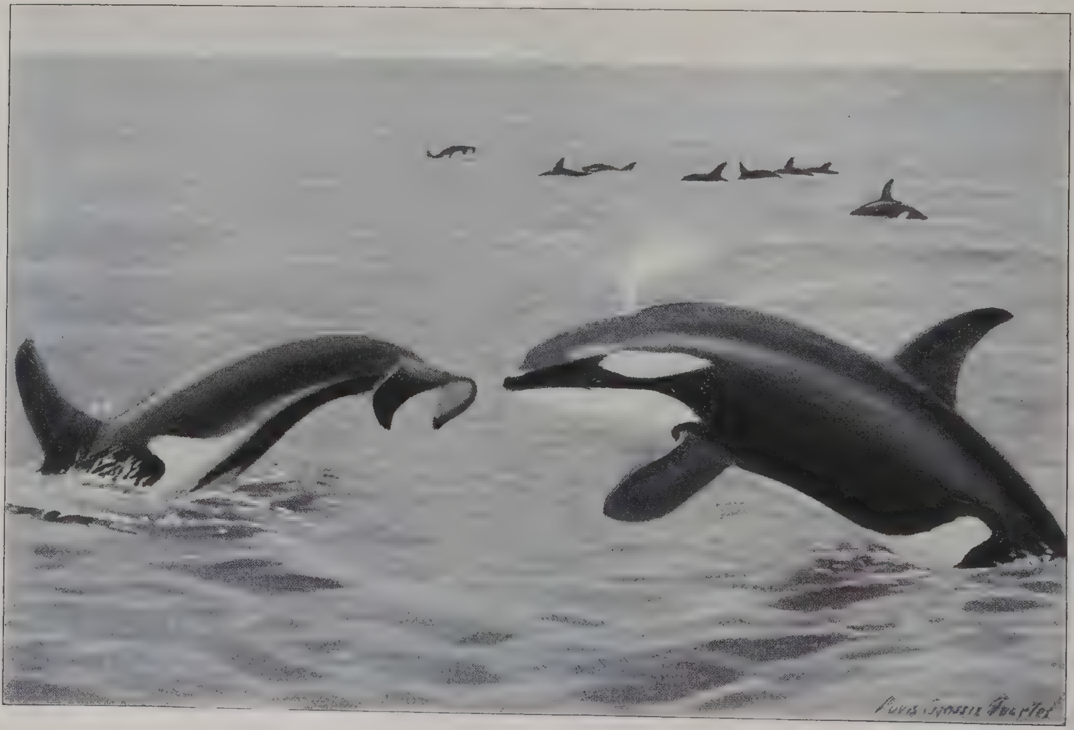
GREENLAND RIGHT WHALE, OR BOWHEAD: **Balæna mysticetus**

(*For illustration, see Color Plate, page* 236)

The Greenland right whale is one of the largest sea mammals, reaching a length of from 50 to 60 feet, and has a marvelously specialized development. Its enormous head comprises about one-third of the total length, with a gigantic mouth provided with about 400 long, narrow plates of baleen, or whalebone, attached at one end and hanging in overlapping series from the roof of the mouth. These thin plates of baleen rarely exceed a foot in width and are from 2 to more than 10 feet in length. One edge and the free end of each plate are bordered with a stiff, hairlike fringe.


Louis Agassiz Fuertes

WHITE WHALE, or BELUGA
Delphinapterus leucas


Louis Agassiz Fuertes

KILLER WHALE
Orcinus orca

The northern seas frequented by these whales swarm with small, almost microscopic, crustaceans and other minute pelagic life, which is commonly so abundant that great areas of the ocean are tinged by them to a deep brown. These gatherings of small animal life are called "brit" by the whalers and furnish the food supply of the bowhead. The whale swims slowly through the sea with its mouth open, straining the water through the fringed whalebone plates on each side of its mouth, thus retaining on its enormous fleshy tongue a mass of brit. This is swallowed through a gullet extraordinarily small in comparison with the size of the mouth. Among all the animal life on the earth there is not a more perfectly developed apparatus provided for feeding on highly specialized food than that possessed by the right whale—one of the hugest of beasts, yet one which feeds on some of the smallest of animals, untold numbers of which are required for a single mouthful.

The bowhead is a circumpolar species, which in summer frequents the Arctic ice pack and its borders, and on the approach of winter migrates to a more southerly latitude. For centuries this huge mammal has formed the main basis for the whaling industry in far-northern waters, first in the Greenland seas and later through Bering Strait into the Arctic basin north of the shores of Siberia and Alaska.

Each large whale is a prize worth winning, since it may yield as much as 200 barrels of oil and several thousand pounds of whalebone. All know of the rise and fall of the whaling business, on which many fortunes were built and on which depended the prosperity of several New England towns.

Whaling served to train a hardy and courageous generation of sailors the like of which can nowhere be found to-day. They braved the perils of icy seas in scurvy-ridden ships, and, when fortune favored, brought to port full cargoes of "bone" and oil, which well repaid the hardships endured in their capture. Many a ship and crew, however, sailed into the North in pursuit of these inhabitants of the icy sea, never to return.

Interest in the brave and romantic life of the whalers still exists, though the most picturesque features of their calling passed with the advent of steam whalers and the "bomb gun," which shoots an explosive charge into the whale and kills it without the exciting struggle which once attended such a capture by open boats.

It has been well said that no people ever advanced in the scale of civilization without the use of some artificial illuminant at night. The world owes a great debt to the right whale and its relatives for their contribution to the "midnight oil," which encouraged learning through the centuries preceding the discovery of mineral oil. It also furnished the whalebone which built up the "stays" so dear to the hearts of our great-grandmothers.

The female right whale has a single young, which she suckles and keeps with her for about a year. She shows much maternal affection, and a number of cases are recorded in which the mother persisted in trying to release her young after it had been harpooned and killed.

Every year, as the pack ice breaks up for the season, the bowheads move north through Bering Strait. As late as 1881 Eskimos along the Arctic coast of Alaska put to sea in walrus-hide oomiaks, armed with primitive bone-pointed spears, sealskin floats, and flint-pointed lances for the capture of these huge beasts. These fearless sea hunters, with their equipment handed down from the Stone Age, were sufficiently successful in their chase to cause trading schooners to make a practice of visiting the villages along the coast to buy their whalebone.

From one of the whaling ships encountered north of Bering Strait in the summer of 1881 we secured a harpoon, taken from a bowhead in those waters, bearing a private mark which proved that it came from a whaling ship on the Greenland coast, thus showing conclusively that these whales in their wanderings make the "Northwest Passage."

Persistent hunting through the centuries has vastly decreased whales of all valued species, and the modern steam whaler is hastening their end. Their only hope of survival lies in wise international action, and it is urgent that this be secured in time.

SPERM WHALE, OR CACHALOT: Physeter catodon

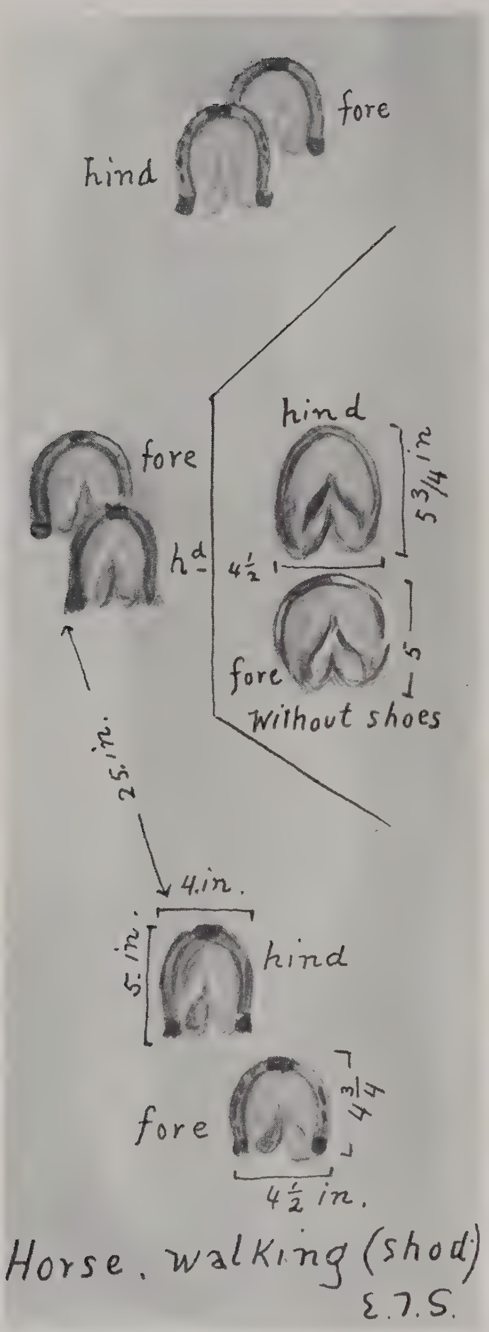
(*For illustration, see Color Plate, page 236*)

The cachalot is from 40 to more than 60 feet long, about equaling the Greenland bowhead whale in size. It has a huge blunt head, which comprises about one-third of the entire animal. The mouth is large and the under jaw is provided with a row of heavy teeth, consisting of ivory finer in grain than that from an elephant's tusk.

The great whaling industry of the last two centuries was based mainly on the sperm and the bowhead whales. The largest of the bowheads is limited to the cold Polar waters, but the sperm whale frequents the tropic and subtropic seas around the globe. The main hunting area for them lies in the South Pacific, but they frequently visit more temperate coasts, especially when seeking sheltered bays where their young may be born. The young are suckled and guarded carefully until old enough to be left to their own devices. Sperm whales sometimes occur off both coasts of the United States, especially off southern California and north to the Aleutian Islands.

The feeding grounds of these whales are mainly in the deepest parts of the ocean, where they cruise about in irregular schools containing a number of individuals. Their food consists almost entirely of large octopuses and giant squids, which are swallowed in large sections.

As befits a gigantic mammal possessing huge jaws armed with rows of fighting teeth, the sperm whale is a much more pugnacious animal than the bowhead. There are many records of whaleboats being smashed by them, and several well-authenticated cases of enraged



THE HORSE

A hunter needs to know horse tracks as much as those of wild game. The greater size and roundness of horse tracks distinguish them from those of mules and asses. When shod, the toe calks are a strong feature; when without shoes, the unbroken front edge is distinctive. Some horses walk in correct register; some do not. Mules are more exact.

bull cachalots having charged and crushed in the side of whaling ships, causing them speedily to founder.

The sperm whale yields oil of a better quality than the bowhead. Its huge head always contains a considerable number of barrels of specially fine-grade oil, which produces the spermaceti of commerce. Ambergris, having an excessively high value for use in the manufacture of certain perfumes, is a product occasionally formed in the digestive tract of the sperm whale.

The name "cachalot" is one to conjure with. It brings up visions of three-year voyages to the famed South Seas, palm-decked coral islands, and idyllic days with dusky islanders. As in the case of the Greenland bowhead, however, this animal has been hunted until only a small fraction of its former numbers survive, and the romantic days of its pursuit are gone, never to return.

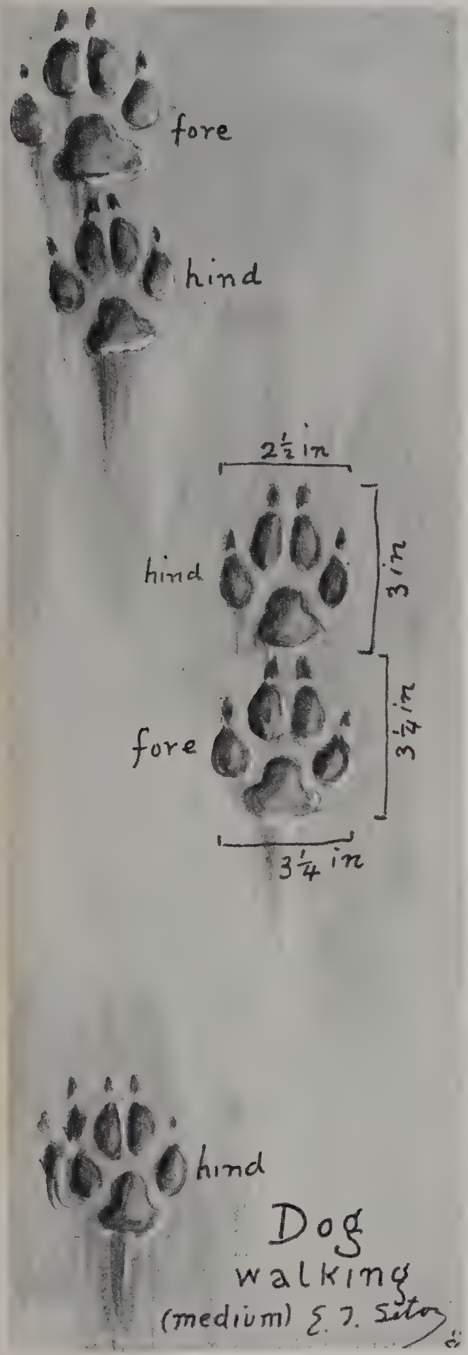
KILLER WHALE: Orcinus orca

(*For illustration, see Color Plate, page* 238)

The most striking and picturesque characteristic of the killer is the large black fin, several feet long, standing upright on the middle of the back. It usually travels and hunts in "schools" or packs of from three to a dozen or more individuals. Unlike most whales, the members of these schools do not travel in a straggling party, but swim side by side, their movements as regularly timed as those of soldiers. An evenly spaced row of advancing long black fins swiftly cutting the undulating surface of the sea produces a singularly sinister effect. The evil impression is well justified, since killers are the most savage and remorseless of whales. The jaws are armed with rows of effective teeth, with which the animals attack and devour seals and porpoises, and even destroy some of the larger whales.

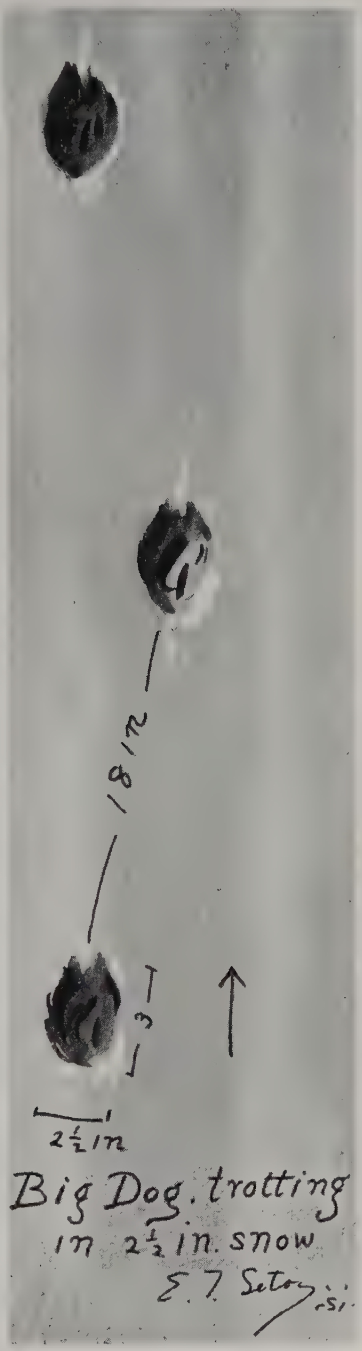
Killers are like giant wolves of the sea, and their ferocity strikes terror to the other warm-blooded inhabitants of the deep. The Eskimos of the Alaskan coast of Bering Sea consider killers as actual wolves in sea form. They believe that in the early days, when the world was young and men and animals could change their forms at will, land wolves often went to the edge of the shore ice and changed to killer whales, and the killers returned to the edge of the ice and climbed out as wolves, to go ravening over the land. Some of the natives assured me that even to-day certain wolves and killers are still endowed with this power and, on account of their malignant character, are much feared by hunters.

Killers are known to swallow small seals and porpoises entire and attack large whales by tearing away their fleshy lips and tongues. When attacking large prey they work in packs, with all the unity and fierceness of so many wolves. The natives of the Aleutian Islands told me that large skin boats were sometimes lost in the passes between the islands by sea-lions leaping upon them in their frenzied efforts to escape the pursuit of killer whales.


fore
hind
2½ in
hind
3 in
fore
3¼ in
3¼ in
hind
Dog
walking
(medium) E. T. Seton

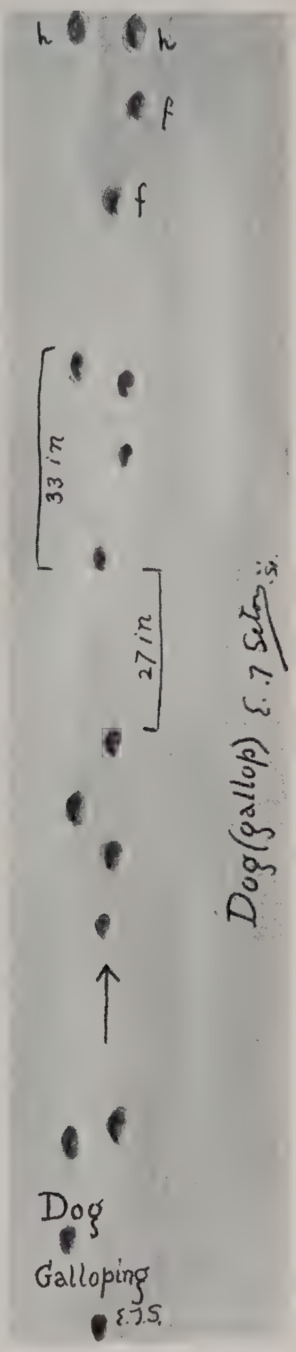
A COMMON DOG'S TRACK

The hind feet are, as usual, narrower, though nearly as long as the front. The dog is a loose walker. Sometimes the hind foot is on the track of the front, sometimes ahead, and often behind. The claws show. The dragging of the front feet is a slovenly habit, evidence of overdomestication.


18 in
3
2½ in
Big Dog. trotting
in 2½ in. snow
E. T. Seton

BIG DOG TROTTING

This track in about two and a half inches of snow is singular in the perfect register it shows. The hind foot drops each time into the track of the front foot. This correct style is more usual with wild than with domesticated animals.


h
h
f
f
33 in
27 in
Dog (gallop) E. T. Seton
Dog
Galloping
E.T.S.

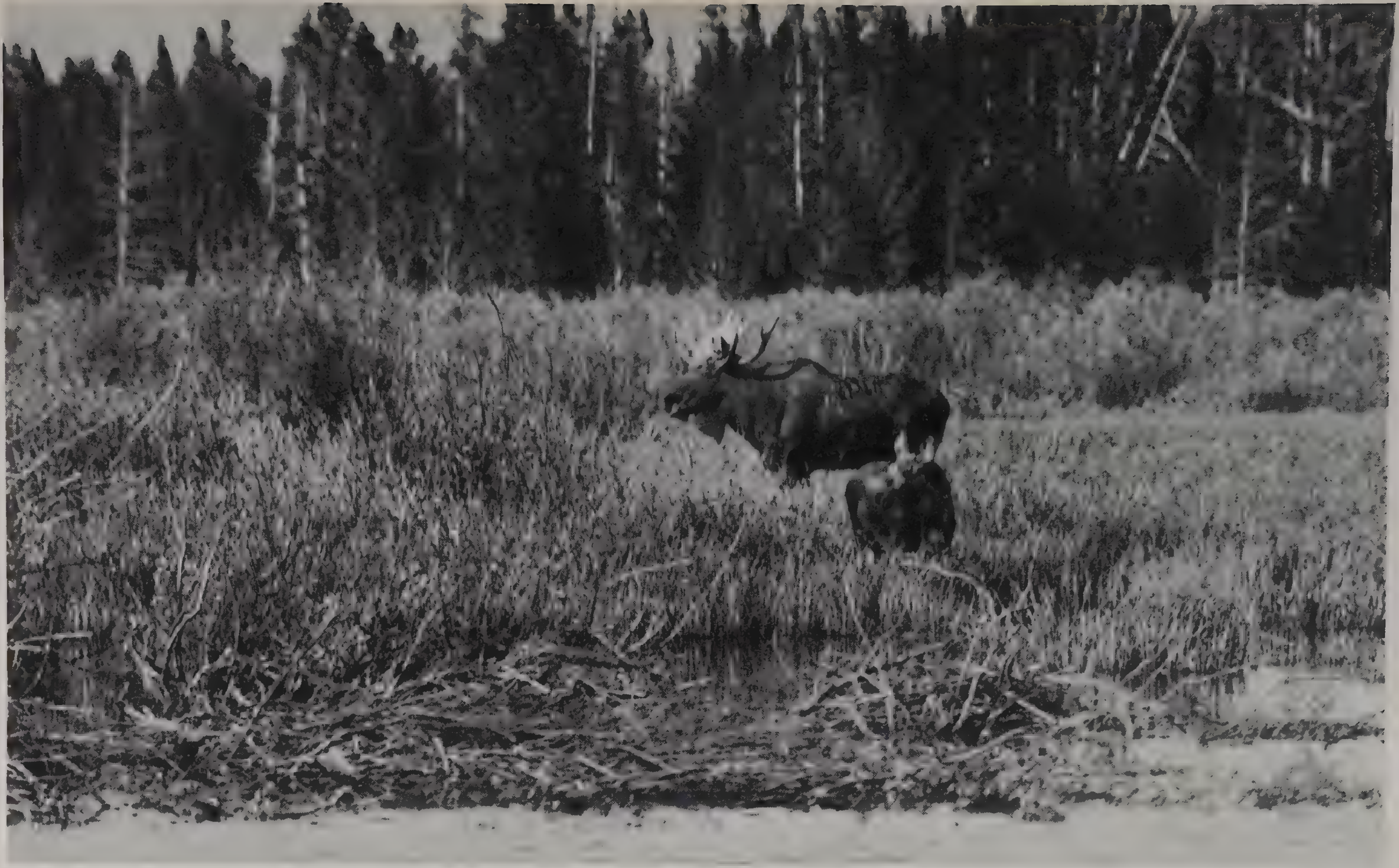
GALLOPING IN SNOW

Note the curious change whereby the right front foot ceases to take first place; no doubt this rests the muscles a little. It is not peculiar to the dog, but is observed in the tracks of many animals.

Photograph by Frank M. Warren

A COW MOOSE COMES ASHORE ON A HOT, LAZY DAY AFTER FEEDING FOR MORE THAN AN HOUR IN SIX FEET OF WATER

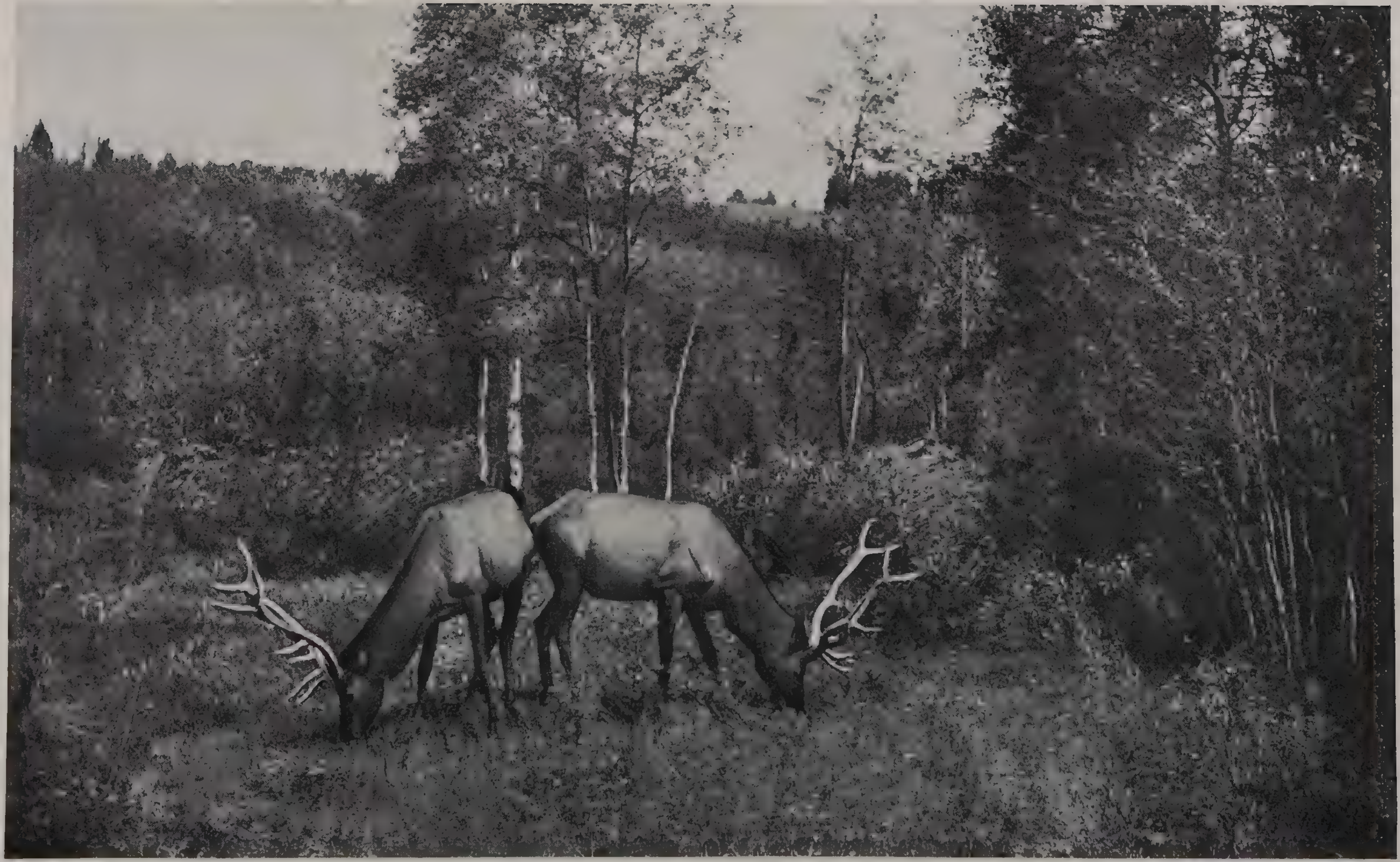
When she put her head down to graze on the bottom of a lake on Isle Royale, Michigan, she was almost entirely submerged.



Photograph by George Shiras, 3d

THE SHIRAS MOOSE IN YELLOWSTONE NATIONAL PARK

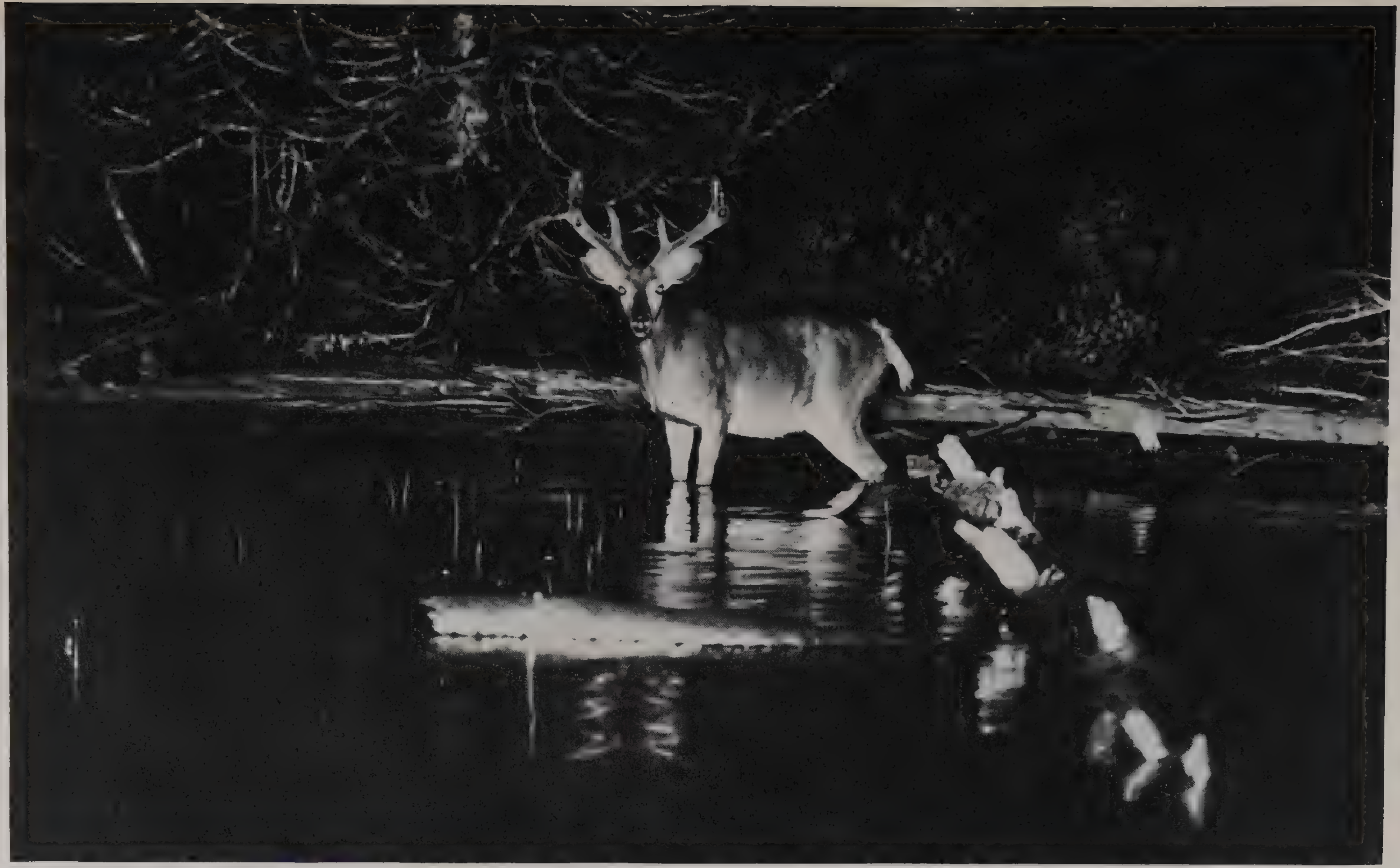
This fine game animal is peculiar to the upper Yellowstone Valley and adjacent region. Little was known of it until 1908, when Mr. George Shiras, 3d, noted naturalist (see page 116), first discovered its abundance about the head of Yellowstone Lake and made it known to the public in articles, especially in the NATIONAL GEOGRAPHIC MAGAZINE for July, 1913.



Photograph by W. J. Stroud.

TWO BIG ELK CAUGHT OFF THEIR GUARD

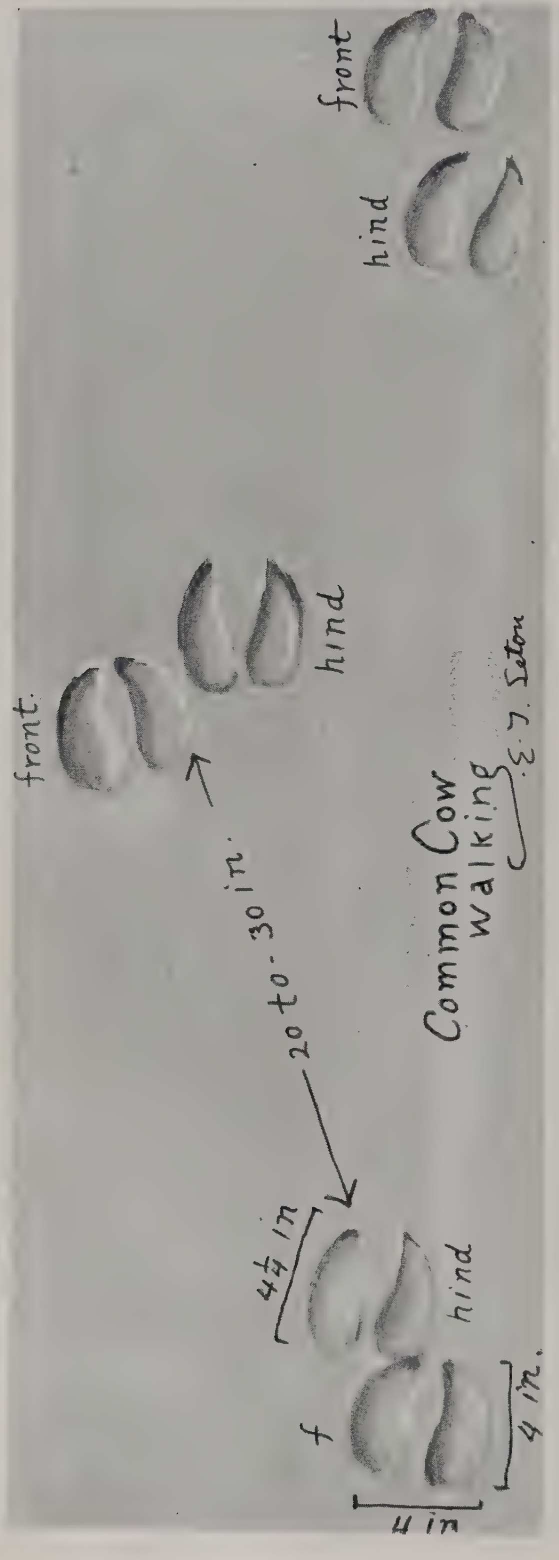
"I was crawling through the tall grass, trying to steal upon two large bulls which were feeding in a little opening in the forest," says the photographer. "Quite a way in the opening was a fallen tree, and if I could only reach that I would be able to get a good picture of them. I finally reached the tree, and set my camera for instantaneous exposure and waited for an opportunity. The silence was broken by the little sounds made by dropping pine cones cut by squirrels and the notes of forest birds, but the elk did not raise their heads. When the opportunity presented itself and the shutter of my camera clicked, they sprang away and vanished."



Photograph by George Shiras, 3d

A LARGE WHITE-TAILED BUCK IN THE VELVET

A flashlight picture taken on Lake Chiniguchi, Ontario. During summer in the northern part of their range the white-tailed deer frequent the shallow lakes to feed upon water plants, but they do not go as deep proportionately as the moose (see page 23).



THE TRACK OF A SMALL COMMON COW

It is well to take the tracks of domestic animals as standards in identifying tracks of wild big game. The roundness of the front foot and the narrowness of the hind are general characteristics. Note that the hind foot is set ahead, beside, or behind the trail of the front foot, but rarely exactly on it. This peculiarity is commonly seen in animals that are accustomed to walk in bogs.

The killers are especially detrimental to the fur-seal industry, owing to their habit of preying upon seals during their migrations in the North Pacific and during the summer in Bering Sea. They also haunt the waters about the Fur Seal (Pribilof) Islands to continue their depredations during the summer. It would be a wise conservation measure for the Federal Government to have these destructive beasts persistently hunted and destroyed each spring and summer when they congregate on the north side of the Aleutian passes. Their destruction would not only save large numbers of fur seals, but would undoubtedly protect the few sea otters still remaining in those waters.

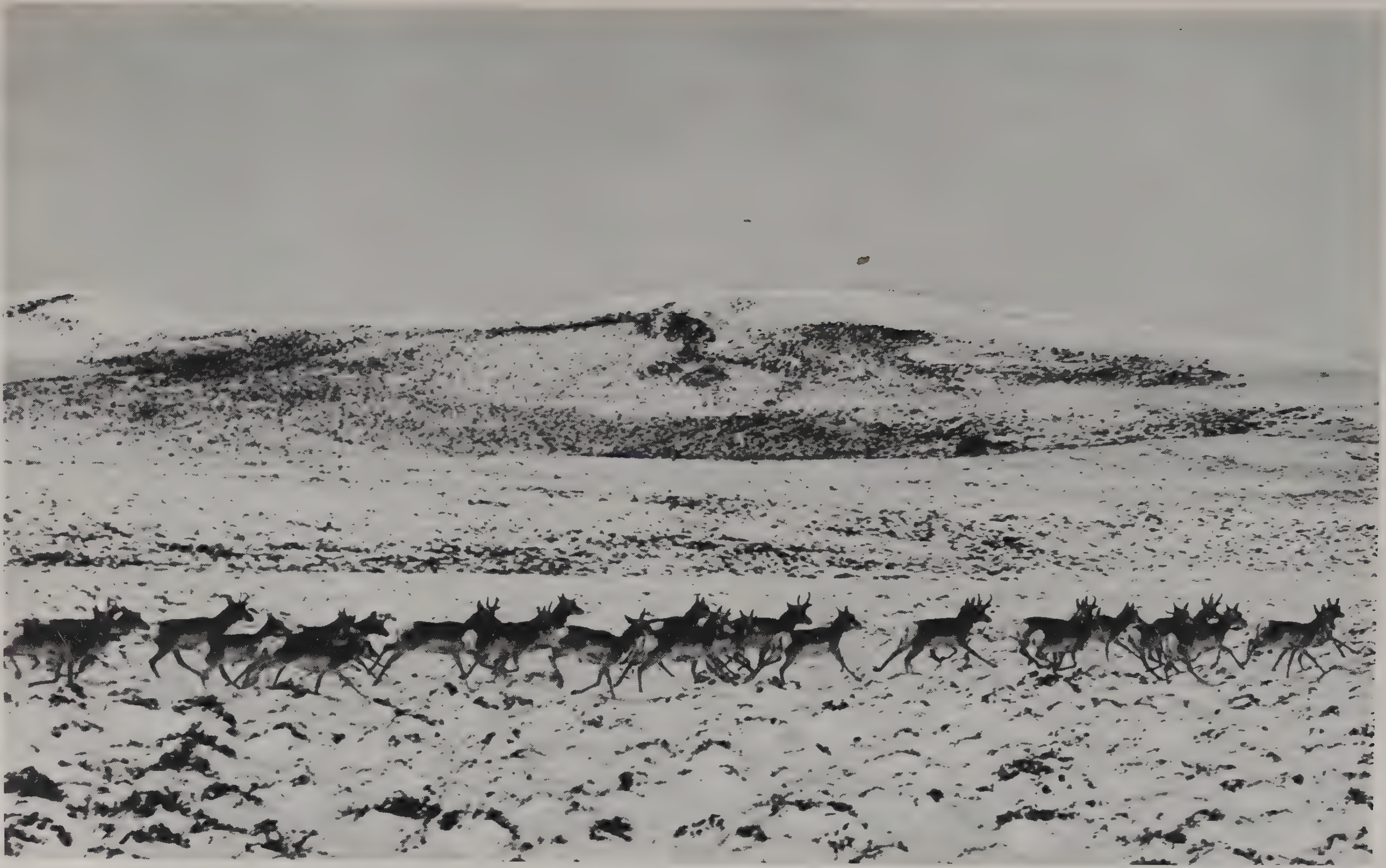
The accounts of the killer whales brought back from the Antarctic ice pack by Shackleton, Byrd, and others show that on occasion even the lives of men when on broken ice have been in danger from them.

WHITE WHALE, OR BELUGA: Delphinapterus leucas

(*For illustration, see Color Plate, page* 238)

The adult beluga is entirely of a milk-white color, and is very conspicuous as it comes up to blow. The young beluga is dark slate color, becoming gradually paler for several years until it attains its growth. The beluga usually lives in the shallow waters alongshore, and not only frequents sheltered bays and tidal streams, but ascends rivers for considerable distances. Plentiful along the coast of Alaska, especially in Bering Sea and the Arctic Ocean, this whale also ascends the Yukon for a long distance. It also comes down the Atlantic coast and enters the lower St. Lawrence.

The white whale is said at times to attain a length of about 18 feet, but its ordinary length is nearer 10 or 12 feet. It travels in irregular schools of from 3 to 10 or 15 individuals and usually rolls high out of water when



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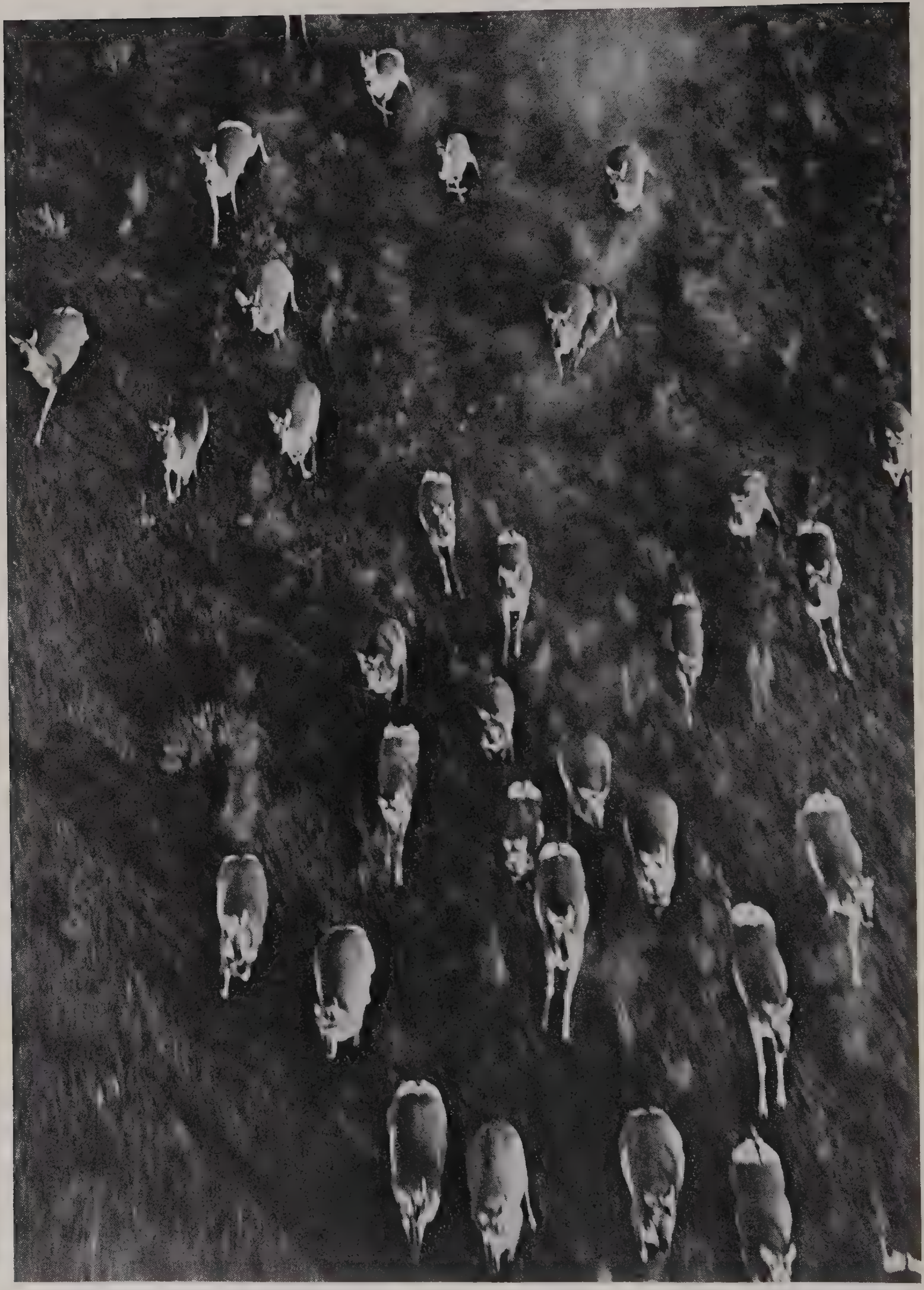
AN UNUSUAL CAMERA SHOT OF A HERD OF PRONGHORNS

The antelope is the fleetest of all American wild animals. As a herd of them dashes by, they present a beautiful and thrilling sight.



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A GROUP OF RUNNING ANTELOPE PHOTOGRAPHED FROM AN AIRPLANE FLYING ABOVE THEM

The white rump patch of the pronghorn (see text, page 218) acts as a danger signal. The hairs are erected in moments of excitement or alarm, but even when they are not, the patch is conspicuous to a distance of from one to two miles as the animal gallops away.

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A SUBSTITUTE FOR HOME AND MOTHER

Two orphaned antelope being raised on a bottle in Montana. It will please all persons interested in wild things to know that in some parts of the West antelope are increasing in number.

it comes up to breathe. It enters sheltered bays and the lower courses of streams, mainly at night, in pursuit of fish, which furnish its main food supply. During the twilight hours of the Arctic summer night, glowing with beautiful colors, the ghostly white forms of these whales breaking the smooth blue-black surface of a far-northern bay add the crowning effect of strange, unworldly mystery to the scene.

When on hunting trips in early autumn, I camped many times on the banks of narrow tide channels leading through the coastal tundra, and for hours during the darkness of night, as the tide was rising, heard the deep, sighing sound of their blowing, as schools of belugas fished up and down the current, often only 15 or 20 feet from where I lay.

The oil and flesh of the white whale is highly prized by the Eskimos, and they not only pursue it in kayaks with harpoon and float, but set large-meshed nets of strong sealskin cords off projecting points near entrances to bays. Young animals are frequently caught in this way.

The beluga frequents broken pack ice alongshore, and one trapped alive by the closing ice north of the Yukon early one winter was reported by the Eskimos to have uttered curious squeaking noises when they attacked and killed it—an interesting fact, as the beluga is said to be the only member of the whale family to make vocal sounds of any kind.

When a school has its curiosity aroused by the approach of a boat or from any other cause, the members often raise their heads well out of water, one after the other, and take a deliberate look, then dive and swim to a safe distance before coming up again.

The small size of the beluga has long saved it from extensive organized pursuit. Recently it has been announced that its skin has become valuable for commercial purposes, and that many are being killed. If this continues, these harmless and interesting animals are likely soon to disappear from most of their present haunts, unless proper measures can be taken to protect them from undue killing.

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NATIONAL GEOGRAPHIC SOCIETY » » Washington, D. C.

Death In The Wilderness

Man and his rifle present only one of the fatal risks to wild creatures.

by **JOHN PATRICK GILLESE**

A RECENT news report from Crescent Beach, Florida, telling of the apparent "mass suicide" of 44 whales brings to my mind similar stories of death in the wilderness which I have encountered, or had brought to my attention, in the last twenty years.

The story mentioned above tells how the whales swam out of a rough ocean and beached themselves. The mammals ranged in size from seven to fourteen feet and, when towed back into the water again, dashed themselves headlong against the shore again in an unexplained fit of hara-kiri. Curators, concluded the news item, had seen the same thing happen in the past.

Suicide is probably even more foreign to the wilderness world than to our own, but at certain times and under certain conditions, nature's creatures will practise it. The "feel" of approaching death, for instance, causes the elephant to leave his fellows and wander for miles until he comes to some swamp. Stoically he walks into the morass until he is buried beneath the ooze. This strange quirk gave rise to the legends about the fabulous "elephants' burying ground," since not until a hunter followed one by accident had anyone ever found where the elephant went to die.

As a boy, I used to watch millions of suckers "running" up Alberta streams in the springtime, to spawn. Driven by an age-old ecstasy, nothing could stop the fish—not even death. Thousands of them would perish every spring trying to leap beaver dams and perishing on the jagged sticks protruding from the sides of the dam.

On the coast, too, I have seen silver

unusual experience of watching two rattlesnakes battle it out to death. What caused the duel, I have no idea. Both snakes were old and big and completely oblivious of any other danger. When I came upon them, they had coiled about each other, till the two seemed one lumpy, writhing rope.

Suddenly one got free by the simple process—for a snake—of throwing his head backward and uncoiling himself, by twirling around and around, from the other body. Both snakes threshed about in the weeds, then slithered towards each other again, hissing and rising in the air.

I was puzzled as to how one snake would kill the other. Then I saw the slightly smaller of the two poise and strike, his rattles going full blast. My expectation was that the other one was poisoned, much as a human would be if struck by the deadly virus. It seemed to have no effect at all, though. Maybe a rattler is immune to snake poison, or perhaps the attacker's fangs could not penetrate the scaly body.

The next move was up to the larger snake, and his tactics were obvious. He slithered alongside the first rattler again, and with lightning swiftness wrapped himself about his antagonist's body. He was able to so straighten out the first snake that it became almost helpless, only about six inches of its neck and head swerving wildly. The conquering snake proceeded to give the *coup de grace* by thrusting its own head inside or over (I couldn't be sure which) the other one's mouth, and undoubtedly chewing and poisoning.

Nothing animal or human has ever equalled that scene for gruesome horror. It lasted more than an hour, from time of my arrival.

river. Occasionally they will break through the thin ice of a beaver dam and perish. Lazy fish will linger in shallow river pools until they find themselves trapped in stagnant water. Every trapper has come across a rabbit, sometimes a coyote, impaled in a spear of wood protruding from some lightning-blasted pine; these fleet animals generally look behind them as they race, instead of ahead.

And on this continent you can count in millions the numbers of small game destroyed by speeding autos, especially in the wooded sections of the country.

Death by lead poisoning isn't reserved for western badmen. A survey conducted in the United States frightened the directors of Ducks Unlimited. Biologists flight-trapped ducks by the thousands, X-rayed them and found the percentage carrying shot in their gizzards almost unbelievable. Ponds, lakes and marshes are literally full of shotgun pellets, which have accumulated after years of shooting. The ducks eat the pellets with their food and many of them die.

Unfortunate choice of breeding grounds means the end of much more wild life. Oil-polluted waters and floods—caused by our forest-stripping during the war—take their toll of waterfowl, while on the prairies of Saskatchewan, millions of nests of Hungarian partridges are plowed under every spring. A friend of mine from the prairie related how, on three sections of land, he had plowed under countless hundreds of mother birds, which refused to leave their eggs.

Probably one of the top-ranking killers of small wild life in the nation is the one you would least suspect—your favorite house cat. Kitty may purr by the hearth all day, but at night he is a primitive prowler, taking an enormous toll of song birds, and such game birds as pheasant and partridge.

CONSERVATION authorities claim that there are over three million homeless cats wandering the woods and countryside of America, and when I was plagued with them on my own trapline, I once tried to figure out how they got there. Number one reason was kindheartedness on the part of men, who, rather than kill kittens, would tie them in a sack, drive out in the country a few miles and let them loose. Others wandered away from bachelors' dwellings and from farm homes. City home-owners contributed their share by gently letting pussy back into the wilds when he was too big, or too rough for the baby, or they had to move to a suite where the owner didn't like cats. It was no wonder that trappers in Alberta were reporting as many as 20 "wild" cats to the square mile.

These felines revert quickly. They are well able to forage for themselves, are much sleeker and fatter than domestic cats. When they breed in the wild state, they revert, both in stature and ferocity, in a couple of generations until they are a dangerous animal for any man to corner. In a single year's time, each cat will account for as many as thirty game birds—an enormous toll in the aggregate.

In the wilderness, death comes quickly, strangely and generally unexpectedly, and though nature's creatures have much sharper wits than ours, their mortality rate is also much higher.

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